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THE UNIVERSAL ELECTRICAL DIRECTORY

(J. A. Berly's).

1914 EDITION.

IN PREPARATION.

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1913—1914.

THE improvement which occurred in the electrical industry during the year 1912 has been maintained during the past 12 months. For most of us the period has been a very busy one, so that the months have flown past. It seems but a very little while since we were briefly reviewing the previous year, and venturing a forecast of what 1913 would bring. We suggested that there would not only be no cessation to the then prevailing prosperity, but that the year would see more electrical business done in both large and smaller classes of manufactures than ever before. We believe that our forecast has proved to be perfectly correct, for on every hand there have been evidences of great activity. It has been difficult for the factories to keep pace with the demand, and manufacturing companies have reported a better rate of profit earned upon their products. And as we step out into the New Year, most encouraging statements reach us, showing that, whether or not we are on the verge of trade depression in some other industrial departments, there is little occasion to fear a falling-off in electrical business during 1914. Large contracts in connection with railway electrification, new power station and distribution work, telephone extensions, and a most gratifying progress in the applications of electricity to cooking and heating, accompanied also by new work in electric vehicles and a continuation of the big demand for electrical devices used in other automobiles—all of these have furnished our factories with plenty to do for some time to come, and there is no prospect of orders falling off at present. Electricity has become so necessary to our industrial and domestic occupations, that it has a practically unlimited and inexhaustible field at home, while abroad the same thing is happening, opening out abundant opportunities which are bound to grow still further as passing years witness the general development of the world.

Some of the well-known manufacturing companies which have for years past struggled with adversity, have carried through financial reorganisation schemes, and on reduced and rearranged capitals they should in future be able to pay dividends if they are securing their share of the present brisker and more profitable trade.

So far as manufacturing is concerned, the year has been comparatively free from actual labour outbreaks, but at times there have been ominous overhanging clouds, threatening general industrial disorganisation if they should burst. A number of local disagreements have arisen between electrical installation workers and their employers, in consequence of demands for higher wages. London is now the objective of the Wiremen's Union, and master contractors have taken special steps in order to negotiate with that organisation. It is impossible to foretell what the course of events may be in the labour world during 1914, for it takes but a spark accidentally struck to set the whole ablaze. This very sensitive state of mind cannot be permanent—the relations of capital and labour are in a state of flux. Someone has got to be master, or stability is impossible. In the interests of prosperity for both master and man, we devoutly hope that there will be no open warfare during the year upon which we have started.

In regard to our foreign electrical, trade for the 11 months so far covered in the year's official returns, the exports of electrical goods and apparatus, excluding machinery and uninsulated wire, were more than a million pounds value in excess of those of the previous year, while machinery exports showed considerably over 3½ millions sterling advance. The aggregate increase in imports in both departments was under £600,000. The total figures were:—Imports, £8,100,000; exports, £39,100,000.

In the sphere of electricity supply, a noteworthy feature has been the continued fall in the price of turbo-generators; the turbines are built for higher speeds, more compactly and yet as efficient as the earlier designs, and so low is the price

that the condensing plant in a recent instance actually cost more than the turbo-generators. The progress of the Diesel engine has been retarded by the high price at which oil fuel still stands, but the year has been marked by the inauguration of a complete gas power installation at Accrington (which is going to be greatly extended) with by-product recovery plant, and by the harnessing of the River Dee for the benefit of the Corporation of Chester, where Mr. Britton now stands in the shoes of the celebrated miller. Good progress is being made with the electric lighting of villages, notably in the hilly districts of Yorkshire, where a number of small water-powers have been utilised.

The development of the applications of electricity continues with unabated vigour, and the chief cities are installing large extensions to their generating plant, almost always involving the use of high-pressure three-phase current and transmission from an external station. It is a matter for surprise that our central-station engineers, with few exceptions, continue to think in small sizes, though Messrs. Parsons have built a 25,000-KW. turbo-generator to a foreign order.

While there is not much to record about tungsten lamps except a further reduction in prices, the ½-watt lamp has been developed, and we are promised that it shall appear on the market before long, when the electric lighting of the streets will receive a further impetus, and arc lamps, with the exception of the flame type, will be hard hit. The opening of several all-electric restaurants during the year augurs well for the future of electric cooking, which, indeed, has made excellent progress in 1913; and the large numbers of radiators now in use prove that, in spite of the cost, electric heating possesses very substantial advantages under certain conditions.

The battle of tariffs goes on perpetually; the "telephone" system and its allies and the "assessment" system are coming more and more into vogue. We look forward to the time when the lighting peak will be relatively so far reduced by the development of "other uses" and by the increasing economy of the lamps, that a flat rate of 1d. a unit, or less, subject to a minimum payment to cover fixed charges, will be the rule. The efforts of the "Point Fives" to extend the adoption of a halfpenny tariff, and to assist manufacturers towards the standardisation of cooking apparatus, deserve a word of commendation.

The electricity supply of London has become a prominent question, and preliminary steps have been taken with a view to its reform, which will be the subject of Parliamentary deliberation this year; a saner view has been taken generally of the relations between companies and communities, and many agreements have been made for bulk supplies of energy.

The formation of an Association of Station Engineers, arising out of correspondence in our pages, has been a notable feature of the year; it is evidence of the existence of a strongly-felt want, which the I.E.E. has hitherto failed to recognise, though there are indications that the matter is receiving more attention in high quarters now.

The opening of several railless trolley systems during the year, and the satisfactory working of these and other installations, affords strong evidence that the motor-'bus does not meet all the requirements of rural districts, in spite of the enthusiastic claims of its supporters—based largely, no doubt, upon its success under the exceptional conditions prevailing in London; the L.C.C. tramways have had a temporary reverse, but are steadily regaining their position, and the outcome has undoubtedly made for the public benefit. Electric traction on railways has made steady progress, although practically no new lines have been put in service except extensions to existing systems. This year we hope to see electric trains running on portions of the North and South Western Railways, and further sections of the Brighton Railway. The N.E. Railway has an important new section in course of electrification. The I.E.E. has arranged for a feast of technical information on the subject for the spring, and we feel that we are on the brink of a vast development in this connection.

An important departure was made by the Lancashire and Yorkshire Railway, which put in operation a new section worked with high-pressure direct current. The East London Railway electrification was at last completed, and started work early in the year, but the Midland Railway to Tilbury and Southend is still only going to be electrified. A start has been made with the great railway scheme of the City of Melbourne, with which good progress should be made this year.

Amongst other noteworthy projects contemplated in the Empire are the electrification of the suburban railways of Sydney and Bombay, the big scheme of the West Australian Government in conjunction with the Corporation of Perth, and the future electrification of some sections of the State Railways in South Africa. Progress in Canada has continued, though hampered by the tightness of money; the Canadian Pacific Railway Co. and the Canadian Northern have decided to electrify portions of their great undertakings. In the Argentine the Buenos Ayres Traction Co. are constructing an important system of electric railways, partly underground, of which one section has been opened. In fact, electrification is now the question of the hour in railway circles. Not only is the complete equipment of tracks going on, but also the use of internal-combustion engines provided with electric transmission to motors propelling the trains is making progress.

In the United States an immense amount of railway electrification is in progress; and the opening of the Lötschberg tunnel electric railway through the Alps has further facilitated intercourse between Italy and the west of Europe.

The first electrically-propelled ship of considerable size built in this country—the *Tynemount*—was completed in the autumn.

The electric vehicle now shows signs of vitality, welcome after the disheartening difficulties which have encumbered its progress in the past, and the supply authorities have taken definite steps towards developing this important outlet for their energy.

In the telegraph field the most notable event has been the settlement of the political controversy which has raged around the question of the Imperial wireless system, and the placing of the first contracts with the Marconi Co., of which the current year will doubtless witness the partial completion. Duplex wireless has been established between Ireland and Canada. Foreign telegraph rates have been further lowered, and a new loaded telephone cable (the longest yet made) has been laid between Newcastle (Ireland) and Nevin, in Wales. The success of automatic telephone exchanges in this country has been demonstrated, and important developments of the system are foreshadowed by the Post Office; a new automatic system, invented by Betulander, has been introduced. Unfortunately, the British telephone service is still very far from satisfactory, and the Post Office appears to be quite unable to raise its efficiency to a reasonable standard. Wireless telephony has been carried on experimentally over a distance of 300 miles.

The properties of radium have been, and are being, studied by an army of investigators, and the immense benefits which it is capable of conferring upon suffering humanity have been more and more fully demonstrated; even cancer, in its earlier stages, has been proved amenable to its influence. Improved methods of extracting radium have been developed, and practically the whole production is devoted to the cure of disease.

During the year there have been called off the stage of human existence an exceptionally large number of men well known, directly or indirectly, in the electrical world. They include:—The Earl of Crawford, Sir Wm. Preece, Sir Wm. White, Sir W. H. Bailey, Sir Wm. Arrol; Professors J. T. Nicholson, J. Milne, F. Gotch, H. Weber and A. Slaby; Dr. Rudolf Diesel and Dr. Gustaf de Laval; Messrs. J. H. Cawthra and A. S. Giles; Messrs. Sydney Woodfield, C. H. Gadsby, and R. S. Erskine; Messrs. J. Howden, H. Aron, Alfred Apps, George Matthey, Arthur Chamberlain, E. M. Underdown, John Trotter and T. Frame Thomson.

The Copper Position.

The copper position has certainly improved since last writing, and at the moment the appearances justify a moderate degree of optimism regarding the near future of business. The tone has certainly improved quite appreciably, and with

it there has been a modified return of confidence amongst consumers, who as a body had allowed their reserves to run down very low. It is noteworthy that the restoration in moderate degree of confidence followed upon the disappearance of the premium on cash copper. It is curious how that, as soon as there are obvious evidences of a manipulated position in copper, as shown by forward deliveries standing at a discount compared with cash, enthusiasm evaporates from the market, and a reaction follows with a depressed feeling, while so soon as the position is reversed, there is immediately a moderate restoration of interest in the position. It was the development of the premium on cash and near deliveries a little while ago that put the finishing touch to the bull movement by inducing all-round liquidation on a heavy scale, and the development of energetic operations by the bears. Actually the depression in prices seems in the light of events to have been carried too far, and we are now in the stage when there should be a rectification of prices based upon intrinsic conditions which, as has been pointed out before in this column, are not so bad. The very worst has been made of everything during the past month or so, and it seems time that there was a new swing to the pendulum. The closing days of the old year, at all events, showed a considerably better feeling, and it would not be surprising if something in the nature of revived interest were taken in the metal by consumers, and possibly, too, by speculators, with the early days of 1914. The statistical situation is far from bad, and, indeed, contains moderate possibilities of a favourable character for the bulls, always provided there are no further untoward happenings, and these good points may have effect soon. There is still but a very small, even dangerously small, visible supply in the world, while the most recent reports as to consumption are rather better both here on the Continent, and in America. In Germany the Siemens Co.'s shareholders have been informed that the company's business continues to develop satisfactorily, and in other directions a rather better account is given of things. The excess of pessimism has indeed passed, it is felt, and should America now settle down to make the best of the new tariff and other matters which have been worrying capital of late, there might quite easily be a very different appearance put on affairs. At all events, the new year is usually a time of hope, and while making allowance for this very natural feeling, there seem substantial grounds for casting gloom aside and taking a moderately cheerful view of industrial conditions and possibilities. The new year will fail, of course, in some of its promises, but there is no reason for holders to be mournful to the point of despair as regards prices. For one thing the threatened big increase in output across the Atlantic has not yet assumed the proportions which had been feared, and this in itself is comforting for holders of the metal and shares, while even if there is to be an advance, it can hardly be of sufficient extent seriously to affect consumption. It may be taken for granted, however, that there is not much likelihood of any really great rise in prices, and that what improvement does occur will not be larger than is to be justified by intrinsic conditions. Lately the market has been rather unduly depressed and the moderate reaction seems fully justified.

Transport Problems in Berlin.

IT was mentioned in this journal several months ago that schemes appeared to be shaping in the direction of the formation of a combination of the principal transport undertakings in Berlin—the Grand Berlin Tramways Co., the Elevated and Underground Electric Railway Co. and the General Omnibus Co. At that time the two former secured a large financial interest in the latter, and since then rumours have been rife, particularly quite lately, that the tramway company proposes to take over a block of shares in the railway company or otherwise establish a community of interests with the railway. It is true that informal discussions of points affecting the two undertakings took place some time ago, but the tramway company now states that there is no foundation for the rumours of a projected community of interests between the three enterprises. The discussions between the tramway and the railway companies did not lead to any practical result, and the negotiations were consequently discontinued. Nevertheless the quotations for the shares of the three transport undertakings have rapidly advanced. Those of the tramway company have fully recovered the loss incurred since last September, but the shares have not reached the level of the quotations which prevailed at the beginning of 1913; and the increase in the shares of the omnibus company has not yet attained the level of 191 per cent. which obtained prior to the announcement of the financial interest taken in the undertaking by the two other companies last August. On the other hand, the shares of the railway have arrived at the unprecedented price of 145 per cent. The course of the quotations and the attitude of the tramways company seem to suggest the possibility of a traffic trust in the near future.

A Report on Companies.

SOME interesting items appear in the Annual Report by the Board of Trade, under Sec. 283 of the Companies' (Consolidation) Act, 1908, for 1912.

The Bankruptcy Act, which was passed in 1913, contains a provision applying the law relating to bankruptcies to limited partnerships, the winding up of which could previously be effected by means of a winding-up order under the Companies' (Consolidation) Act, 1908; the provisions of that Act which relate to the winding up of limited partnerships have now been repealed as regards England.

The total number of limited partnerships registered since the Limited Partnership Act, 1907, came into force, is only 530. Its provisions have not, therefore, been made use of to any considerable extent, which is, doubtless, largely due to the fact that in the same year that the Act was passed a section was included in the Companies' Act, 1907, granting certain exceptions and privileges to companies (to be called private companies), which included in their articles of association the restrictions laid down by that section.

Perhaps the most interesting case of a company against which a winding-up order was made during the year may be noted.

The A, Ltd., with a nominal capital of £100 in 1,000 shares of 2s. each, was formed in 1912. It was promoted by A for the purpose of acquiring from himself, his wife and family, the whole of the assets of A & Co., Ltd., of which they had possession as the holders of the debentures, for a certain sum. The consideration for the transfer was the issue to the holders of debentures in A & Co., Ltd., of debentures for a similar amount in the new company. The sole director of the company was the promoter, and his son acted as secretary; all shares were issued and were subscribed for by them.

This method of forming a new company to acquire the assets of the old company by means of the issue of debentures appears to have been first adopted by the promoter A in 1899, and there have been not less than 14 limited companies, of which the present company is the direct outcome, promoted by A, and of all of which he was the sole director, each company being formed for the purpose of acquiring and continuing the business of its predecessor. The promoter, in taking advantage of the limited liability Acts, has been able to trade without making himself personally liable for the debts contracted in the name of the company.

In 1912 the promoter A took possession of the company's assets for the debenture-holders, and yet another company was registered to which the assets have been transferred by the receiver for the debenture-holders for debentures in the new company. There are consequently no assets for the unsecured creditors.

THE EVOLUTION OF THE MODERN OIL SWITCH.

By W. J. P. ORTON.

It is a fact worth remarking that the first commercial oil switch to be put into regular use was invented and designed by Mr. Ferranti about 20 years ago.

This oil switch had its main contacts in air, and only the auxiliary break in oil. It, however, differed in one essential point from the modern switch in that the final break took place on the surface of the oil, the arc being smothered by drawing one of the contacts well under the oil. This feature has been superseded in all later designs, the endeavour now being to immerse the arcing contacts under a good head of oil.

Another feature of Mr. Ferranti's switch was the quick break, and the importance of this has been thoroughly realised at the present date.

Concurrently with this switch, the Continental and American engineers were developing a line of air-break switches, in which the horn break was the essential feature of the former, and a quick long break from carbon contacts of the latter. These types, however, were short-lived, owing to the increasing size of generators to be controlled, and to the electrical disturbances which were set up by the long pulsating arc in air.

The design which next appeared hailed from the States, and was in a form with which we are now all familiar, and which, except in some rather important details, still prevails. In order to reduce fire risks, particular care was taken to keep the quantity of oil in the cans at a minimum. This theory has, however, been abandoned, and the volume of oil has been increased as much as possible.

The chief reasons for this change are that on severe short-circuits a certain quantity of oil is thrown out of the can even when special precautions are taken, and a large volume of oil is necessary both above and below the arcing contacts in order to drown the arc.

In the early stages of the oil switch design it was recognised that for the safety of the operator and the switchgear as a whole, it was important to place the oil switches in fireproof cubicles remote from the panels, and since remote mechanical operation presented many difficulties, and in some cases was impossible, the electrically and air-operated switches were evolved. The former have been the more successful, and have now been standardised into two main types, viz., solenoid operated and motor operated.

Considerable ingenuity has been displayed in the mechanical development of these two varieties, but space only permits of the consideration of some of the features of the former. There are, however (or, perhaps, one should say were), two points in which the solenoid-operated switches were imperfect, viz. :—

1. They were not loose-handled ; that is to say, an operator, by keeping the control circuit closed on the solenoid, would cause the main switch to remain closed, or to keep on closing on a short-circuit or overload.

2. The break was not as quick as it should be, since when the throw-off springs were made sufficiently strong the solenoid was either too weak to close the switch, or assumed such proportions that the closing current became excessive for the work to be done, and the mechanism could not be made suitable to withstand the violence of the closing movement.

It is possible to overcome the first disadvantage in several ways, and the two which have been frequently adopted are either to design the apparatus which governs the control circuit so that its movements are, to a large extent, independent of the operator, or to make the closing mechanism of the oil switch itself on the loose-handled principle.

The first method has the advantage of simpler design, since the controller which completes the circuit through the closing or tripping solenoids can be made loose-handled without any great exercise of ingenuity, the parts being small and light, and without any great mechanical strain upon them. An alternative scheme is to develop the controller mechanism so that it operates automatically by the use of a push button.

The second method, in which the loose handle on the oil switch itself is employed, though utilising a well-understood feature, is more difficult of application. This is due to the heavier masses to be moved, and to the large stresses which the moving parts have to undergo. It is important, moreover, that the loose-handle lever to which the solenoid plunger is attached should, in the event of the oil switch opening, reset itself without fail in readiness for the next closing operation.

In order to produce a mechanism which can be depended upon in all emergencies, great attention has had to be given to all details ; but, in spite of obstacles, the desired result has been satisfactorily attained.

The above short description gives a slight insight into some of the problems which confront the would-be designer, and of the difficulties which have been surmounted with varying degrees of success.

With the advent of the large power stations which are now built or being contemplated in all civilised countries, manufacturers of switchgear have been called upon to give very stringent guarantees for their oil switches, and to meet conditions quite new and unexpected. It has, therefore, been necessary most carefully to scrutinise all the details, and to carry out extensive and costly experiments, to enable oil switches to be made to withstand the severe conditions of modern practice.

It is, in fact, quite a common occurrence to provide switchgear for generating stations which normally have 50,000 H.P. or more of plant connected to the bus-bars, which, on short circuit, is capable of giving an output of at least three times its normal capacity.

Under these onerous conditions experience has shown, chiefly in America and on the Continent, that it is possible, when rupturing a short, to produce a violent explosion in the oil-switch tanks, which, in the older types of design, frequently resulted in the oil tanks being blown off, the oil set on fire, and the switch itself wrecked.

Invention, therefore, has been stimulated by necessity, and certain essential features of design have become standardised. For convenience, they may be summarised under the following headings :—

1. Strong mechanical design.
2. Reliability in operation, whether opening or closing.
3. Ease of inspection.
4. Quick break.
5. Adequate length and number of breaks.
6. Strong cans, and supports for the same.
7. Large volume of oil.
8. Sufficient head of oil above contacts.
9. Expansion chamber above the oil, with relief vent for the escape of gases.
10. Separation of phases, both in the tanks and outside them.

In explanation of the above essentials, it is unnecessary to remark on the first two, but the third calls for the particular attention of the designer, since it is a point which is easily overlooked. In order to keep oil switches up to the highest pitch of excellence, they should be frequently overhauled to ensure that the oil is clean and free from carbonisation ; that the main and arcing contacts are in good condition and alignment, and that all the mechanical parts are in working order and properly oiled to minimise friction.

It is obvious, from the foregoing, that not only should a switch be carefully inspected, whenever possible, after it has ruptured a severe short circuit, but those responsible should satisfy themselves that everything is up to concert pitch before any trouble occurs.

Nos. 4 and 5 are self-explanatory, except that it would be well to point out that by "quick break" the writer does not mean instantaneous action on a short, but rapid acceleration of the moving parts, when once the switch has begun to operate.

The number of breaks is usually confined to two per phase, but in some of the largest capacity these have been increased to four or more, especially when designs have been elaborated to include additional contacts to enable resistance or reactance to be introduced into the circuit before finally

rupturing it. The latter method has been successfully attempted in the United States, and by the use of comparatively small reactance coils almost unlimited shorts have been interrupted without the switching apparatus being put out of action.

With regard to No. 6, it need only be said that it is just as important to have the strongest possible can supports, as to have a can which will stand up to the high internal pressure.

Nos. 7 and 8 may be considered together, as it is evident that a large head of oil over the arcing contacts, in order to be effective, necessitates a large volume of oil. At the same time, the greater the volume, the longer it will take to reach the danger point produced by gradual carbonisation.

The expansion chamber above the oil referred to in No. 9 is a feature of design that has only been recognised quite recently; but tests have proved that the existence of this chamber relieves the pressure inside the can when a heavy arc suddenly generates gases, and if in addition a baffled vent is provided, these gases are allowed to escape without the head of oil above the contacts being sufficiently reduced to need attention after every operation.

The necessity of the separation of phases mentioned in the last item, No. 10, is self-evident, since, if an arc should hold on for an appreciable length of time between phases or between contacts of the same phase, the switch is in danger of being badly burnt and rendered unserviceable.

The reader will appreciate from the foregoing how complex the design of large oil switches has become, and that a piece of apparatus which was formerly looked upon as fit for a junior draughtsman to tackle now needs all that experience and invention can evolve. These results, moreover, have only been arrived at by switchgear manufacturers after many mistakes, and by the expenditure of much time and money.

LONDON UNIVERSITY: A CRITICISM.

By G. E. MAPPIN.

MUST we wait for another Lord Roberts to rouse England to a sense of her educational unpreparedness? How long will it be before we realise that, as in the Territorial Force, the training in our technical universities is too short?

Some time ago I returned to England after completing my education abroad, where I studied at two German technical universities and underwent a course of practical training in German works. I cannot but express surprise at the lowness of the standard required at home. To prove this, let us compare the latest programmes of London and Darmstadt Universities as regards electrical engineering.

Prospectus.—One must regretfully admit that the German is better arranged. The different programmes are placed together and contain numbered lists of the subjects read, with the hours devoted to each. A numbered syllabus of lectures is given, which enables the students to see at a glance what is studied, and makes it possible for them to choose any supplementary subjects they like.

Further, there is a detailed list of tours and excursions (some 28 in number), undertaken, during the past year, by professors and students of engineering, chemistry, and architecture, in which they visited various towns, works, &c., throughout Germany, Switzerland, and Italy. There is nothing corresponding to this in the English publication.

Examinations.—The passing-out examination of the German public schools, required of all undergraduates, is considerably harder than the "entrance" to an English University, yet the German course for architecture, chemistry, and engineering is four years in length, compared to the three generally required in England. German engineering students must go through at least one year's training in a works before taking the final examination.

Subjects Omitted at London.—Neither the time-table at Darmstadt, nor at any German University, is filled to its full capacity with subjects necessary for the examination, as seems to be the case at home, and for two reasons: to avoid overtiring the students, and to enable them to hear lectures that improve their general education, thus giving free play to the self-education so much under discussion at the present time.

The German programme devotes, in general, more time to any given subject than does the English, and is therefore more thorough.

The following lectures given at Darmstadt do not appear to be part of the curriculum of electrical engineering in London.

As part of the four years' course, we have Industrial Politics; Water-power Plant; Machine Planning; National Economy.

Then during the course it is recommended that the lectures on Water-power Machines, Elements of Law, Literature and History, and other subjects should be attended.

Lectures are also held on Factory Planning; Wireless; High Tension; Socialism and the Working Man; Finance, Credit and Banking; National Income and the Formation of Classes.

Criticisms and Suggestions.—Now what are the views of the University authorities on the subjects enumerated above? They must either (1) disapprove, or (2) approve of their being read.

If 1—On what grounds do they place themselves in opposition, not only to German, but also, I believe, to French practice?

If 2—Why do they not create fresh chairs?

If they have not the money, two courses appear open to them.

(*a*) To ask for funds from the City, the County, or the Government.

(*b*) To ally themselves with other Universities to urge the Government to give them a larger grant or to empower them to levy a University rate on counties in the neighbourhood of University towns.

We English pride ourselves on our thoroughness. I ask, with all deference, is the London programme thorough?

The Works of the Future.—The era of "mixed" works dawned some years ago, and they will become the works of the future. Our Consular reports from Frankfort O/M show the parlous state of the German "pure" works, due to the former's competition. When the "mixed" works increase in England, the same fate will overtake the "pure" concerns (*i.e.*, those not owning their own sources of raw material) on this side of the North Sea. What have the University authorities done to meet these changed conditions? Practically nothing! Or do they consider that the English course gives any lectures equivalent to the numerous chairs on the above subjects at a German University? What training are they giving to the future engineers, who may ultimately hold in their hands the fate of vast concerns, owning iron and coal mines, docks, canals, railways, cableways, blast furnaces, water-power stations, rolling mills, and erecting shops? Can they maintain that our training is in any way to be compared with that given in Germany?

We complain of the difficulties that beset a long theoretical course in this country. The Universities, I think, are largely to blame. Why do they divorce theory from practice, and grant degrees without insisting on at least one year's previous training in a works? Do they imagine that a few hours a week in the University workshop can be substituted for this?

The University Degree must be given after a long *practical*, as well as *theoretical*, training, and should not be based on the results of the latter alone. The degree should never be given on a three-year course, as this does not allow sufficient time for studying the subjects above-mentioned.

The authorities may be afraid that if an engineer be not employed before he is 25 or 26, he will find it hard to obtain a post, but modern conditions demand a more lengthy training than was formerly necessary. Let them state boldly what they *know* to be the irreducible minimum of instruction required. Compromise is at once the strength and the weakness of our race; there must be none as regards technical education. The best is good enough for us, should be our motto. Of course, it will be difficult to

convince people. In order to strengthen the hands of the Universities, a

Technical Education League

must be formed, with a definite programme, and propaganda made throughout the country, ere we can hope to arouse public opinion.

Is it too much to hope that one or more public-spirited manufacturers will come forward and provide funds for starting this league? An engineer, with a thorough knowledge of French and German, should be sent to visit a few works and to attend, say, a dozen lectures at one or two of the Technical Universities in these countries, this to be followed by a similar tour in England. He should issue a confidential report, the advice of perhaps three educationists would be taken, and programmes for engineering, chemistry, and architecture would be published, as the principles of the league. At the same time, technical education for the workmen on the thorough system in use in Germany would find a place in the propaganda.

These are, I know, very hard words, but I would ask it to be remembered that I am speaking from personal experience, acquired in England and during the time I spent in Germany (a time in which I had many opportunities of studying German industrial and economic conditions), and from facts obtained in visits to firms such as Krupp, as well as during a students' tour to various towns extending from Duisburg to Emden and Bremen.

London is the most important town in the kingdom; if we can persuade her University to move, we shall have gone a long way towards the educational reform of our country.

THE NEW SWITCHGEAR RULES OF THE V.D.E.

[COMMUNICATED.]

The switchgear standards which have recently been compiled by the Verband Deutscher Elektrotechniker (German Society of Electrical Engineers), and published in a preliminary form are, to all intents and purposes, the first attempt to treat the subject from a practical and scientific standpoint, and are a great advance on any similar set of rules which have been made public. Though switchgear as a whole is treated in this publication, by far the greater part deals with oil switches. The tables given are arranged in quite a novel manner and, in the author's opinion, the method of treatment is on the correct lines.

To begin with, the standard working voltages and currents are set forth, and little exception can be taken to these except that the low current ratings for H.T. apparatus of 2, 4, 6 and 10 amps. can seldom be required, and even if they were from an electrical point of view, they would be inadvisable from a mechanical one, since, if made of the correct dimensions for such small currents, their construction would be flimsy, or if made strong enough they would at once become as expensive as the larger sizes, and the *raison d'être* of their existence would vanish.

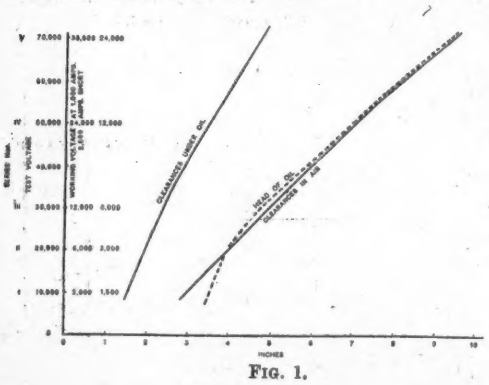


Fig. 1.

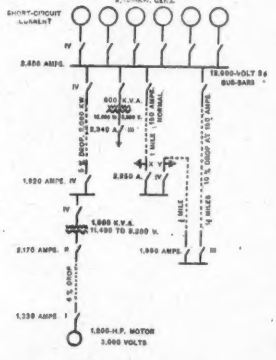


Fig. 2.

Under Rule 4 the new method of rating appears, *i.e.*, the apparatus is to be chosen not only according to the voltage and working current, but according to the calculated permanent short-circuit current to which it could be subjected in its position at the generating station, or on the distribution system. It may be said that the word "calculated" is the fly in the ointment, and that the calculated current may in practice be very different from the actual current.

If the reader, however, follows closely the examples given in the Rules, he will notice that estimates of the permanent short-circuit currents are in line with practical experience, and if they err at all it is on the high side with one exception, *i.e.*, no account is taken of the stored energy in the system, such as is represented by rotaries and other running machinery. On consideration, however, it may be assumed that this energy is largely dissipated before the oil switch comes into action, especially when it is remembered that the great majority of automatic switches are fitted with a time lag to prevent instantaneous operation.

The curves given in fig. 1 are an attempt to translate the figures tabulated in the German rules, but it will be seen that the method of rating the oil switches on their test volts makes it difficult to draw comparisons between German and English practice. In order, however, to make this possible, the author has given two columns of working voltages alongside the test voltages. The first column gives the working pressure for a permanent short-circuit current of 1,000 amps., and the second for 2,000 amps., though for a rough comparison the latter column can be neglected.

Let us consider, in the first case, the curve giving the clearances in air. These are undoubtedly larger than is usual either in English or American practice, and would necessitate wider spacing, not only in the switch parts themselves, but in the arrangement of brick or moulded stone cubicles so common in this country. On the Continent unenclosed iron structures are more common, and no doubt this design was in the minds of the framers of the Rules when settling these dimensions.

The clearances required under oil approximate closely to standard English design, except for voltages below 10,000, which is chiefly accounted for by the high test voltages specified, these being as high as three times the normal working voltages. In the Standardisation Rules published by the American Institute of Electrical Engineers, and those by the British Electrical and Allied Manufacturers' Association, the test voltage called for is only twice the normal for voltages of 2,500 and 2,250 and above respectively, though the time of application, viz., one minute, is the same in all three cases. It may be agreed, however, that at the lower working voltages faulty spots in the insulation do not show up in the short time of one minute, except with a test voltage of 10,000, and there is a good deal to be said from this point of view.

The third curve, giving the requisite head of oil above the arcing contacts, also closely agrees with English practice, and is a recognition of an important feature frequently neglected.

At first sight it would appear that some important points in the design of oil switches have been overlooked, but it will be seen that the volume of oil in the tank is practically fixed when the dimensions for clearances under oil and for head of oil are specified. The length of break under oil is purposely omitted, as great differences of opinion exist on this point, and it also depends to a certain extent on the design of the switch itself.

In order to make the calculations of the short-circuit currents clearer, the diagram given above, fig. 2, has been drawn.

It is assumed that there are six 3,000-kw., 12,000-volt, three-phase generators running in parallel on the bus-bars, and in addition four types of feeders are shown. The first feeds a sub-station, where the voltage is reduced to 3,000 in order to supply power to a 1,200-h.p. motor in the neighbourhood. The second feeds a step-down transformer in the generating

station, while the third and fourth supply a ring main with two sub-stations.

The currents given in the figure are the permanent short-circuit amperes, and the Roman numerals refer to the series number of oil switches, as specified for these currents in the German rules.

It is obvious that all oil switches directly connected to the bus-bars should be of the same capacity, and capable of dealing with the short-circuit current of 2,600 amperes. A good example of the decreasing capacities of oil switches in series is given on the first feeder, where the size at the source of power is No. 4, while at the motor No. 1 size only is necessary.

The ring main feeders present a little difficulty, since if a short were to occur at x the oil switches in the adjacent sub-station need only have the capacity of No. 3, but if the short took place at y it would be necessary to have the larger capacity represented by No. 4. Since, however, the worst condition must be provided for, No. 4 switches would have to be installed in this sub-station.

In the second sub-station, which is situated at the middle point of the ring main, the largest short-circuit current which would occur only necessitates No. 3 oil switches, but for the sake of uniformity and interchangeability, most engineers would install No. 4 oil switches throughout the main, provided the cost of this larger switch was not prohibitive.

Referring to Rule 11, where the maximum allowable rises in temperature are given, sound discrimination is shown in allowing 40° C. rise for switches above 2,000 amperes, whereas those for 350 amperes and below are only allowed 20° C. rise. The reason for this is self-evident, since this temperature is measured on the surface of the oil, and in the smaller sizes of switches, where the masses of the copper conductors under oil are small, these might easily reach a temperature considerably higher than that at the surface of the oil.

Rule 16 calls for an unusual device intended to discharge the voltage rises occurring in normal service. This would probably take the form of a horn gap or non-arcing cylinders, but it could not be very reliable, and under most circumstances it would be advisable to construct the switches in such a way that their insulation should stand up to the surges in voltage.

Rule 20 is especially interesting, because it gives the relation between the normal current and the short-circuit current by which the sizes of the current-carrying parts are decided. The rated current is allowed to increase 250 times without time lag, and 150 times with inverse time lag, that is to say, it is assumed that the shortest time in which the relay will act is about $1\frac{1}{2}$ seconds. The latter time is on the small side, and it would probably be safer to increase it to two seconds.

Relays with predetermined time lags independent of the intensity of the current are not much used in Germany, and this may explain the small increase of current over the normal which is allowed. This is given in the Rules by the formula $100/t$ where t is the time lag in seconds. It is not apparent why the formula $150/t$ should not be used, and assuming the author's figure of two seconds for the minimum time of action of an inverse time limit relay, the formula would then become $150 \times 2/t$. If the predetermined time limit were fixed at five seconds, then the maximum allowable permanent short-circuit current for an oil switch under these conditions would be $150 \times 2/5 = 60$ times the normal current.

Charge of Stealing.—Burnley Corporation having missed much copper wire, a watch was kept upon the electricity works. On December 15th, Wm. Denton (33), Peter Street, employed in the overhead equipment department, was seen to leave with two bags containing 145 lb. of copper and 24 lb. of brass. At the Police Court, on December 24th, a hope was expressed that the Bench would inflict a punishment which would be a deterrent to others. For accused it was explained that he had a wife and four children and an aged uncle to maintain. Prisoner was bound over.

THE IGNORANCE OF HOME OFFICE REQUIREMENTS.

BY FRANK BROADBENT, M.I.E.E.

THE increasing number of Home Office prosecutions of employers for non-compliance with the electricity regulations under the Factory Acts would appear to indicate either that the factory owners are not familiar with the requirements, or that they are prepared to take a sporting chance of not being found out; or, alternatively, if found out, of pleading ignorance of the law.

But how very few of us have anything beyond a very superficial knowledge of the laws which we daily incur the risk of breaking. We are prepared generally to leave it to the experts, the lawyers—to keep us right and to get us out of any scrape we may unwittingly get into, well knowing that a plea of ignorance of the law will not avail as an extenuating circumstance for breaking it.

The factory owner or employer who uses electricity for lighting or power, no doubt relies in the same way on "electrical experts," under which term he often includes anyone who sells or installs electrical apparatus.

In a recent case, in which Messrs. William Bayliss, Ltd., were fined £55 and costs for non-compliance with certain of the regulations, resulting in injury to a workman from a defective hand lamp, it was stated that "electrical experts" had seen and tested the apparatus only 14 days before the accident occurred, and that the defendant firm had been "let down" by these experts.

It would be interesting to know the qualifications of the experts who had inspected and approved a piece of apparatus, which was obviously not in accordance with the Home Office requirements, as according to the published reports the guard was in metallic connection with the lampholder, which was not earthed.

According to the reports, Mr. Ram stated that on testing the lampholder he found that the potential difference between lamp terminals and earth was 440 volts, although this was nominally a 110-volt installation. It appears that the lighting circuit is taken from a 440-volt three-phase circuit through an auto-transformer, and it was stated that the single-pole switch was, therefore, not sufficient to disconnect the lamp from the 440-volt mains. This point is not very clear, for although a single-pole switch obviously cannot disconnect two poles, if the auto-transformer were properly connected up, a single-pole switch ought to be sufficient to disconnect the lampholder terminals from the live main and reduce the pressure to earth potential. This, however, can only be done when the transformer is connected between one of the line terminals and the neutral point of the system. We then have very much the same conditions as occur in an installation connected to one side of a three-wire D.C. network. It is essential to connect the switches on the live and not on the earthed side of the system, as if placed on the earthed side, the full potential exists between the lampholder terminals and earth, even when the switch is off.

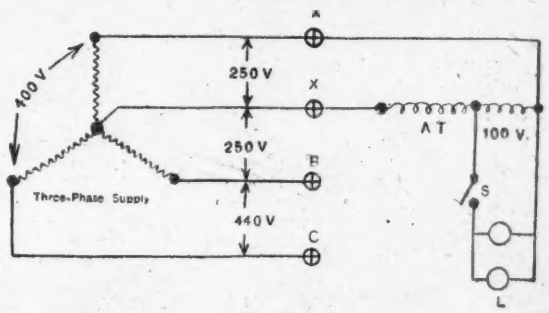


FIG. 1.

It is, however, perhaps not sufficiently appreciated that there is a right and a wrong way of connecting up an auto-transformer to an alternating-current circuit, and the two methods are shown diagrammatically in figs. 1 and 2. In fig. 1, which is the wrong method, the transformer winding is connected to one of the outers and the earthed neutral, the

low-pressure tapping being taken from the outer terminal and a lower point which gives the required lamp pressure, say, 100-volts. If the lamp switches are connected to the neutral side of the circuit, it is clear that even when switched off, the lampholder terminals would show the full potential difference between the line and earth, that is to say, the full

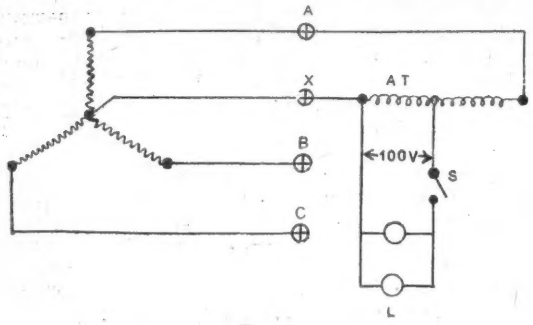


FIG. 2.

phase difference of potential, say, 250 volts. If, on the other hand, the switches are connected in the live side A, the lampholder terminals would, even when switched off, show a difference of potential of 150 volts to earth. In other words, if the phase voltage is 250 and the lamp circuit taken from the auto-transformer is 100 volts, the potential difference between the lamp terminals and earth would in the one case be 250, when switched off, and in the other case 150. The correct method is to connect up, as shown in fig. 2, in which the lamp circuit is taken off the neutral end of the transformer. If now the switches are connected up on the live side, that is the terminal nearest to the outer line, the lampholders are dead or at earth potential when switched off. Apart from factory work, there are, no doubt, quite a number of private house installations using low-voltage circuits taken through auto-transformers from public supply mains, in which the lampholders and other fittings are always subjected to a fairly high pressure when the switches are off and the wires are supposed to be dead.

From the evidence given in the case against Messrs. Bayliss, it would appear that the lighting installation in question was taken from an auto-transformer connected up across two lines of a three-phase system, as shown in fig. 3, and not between one line and earth. Under these conditions,

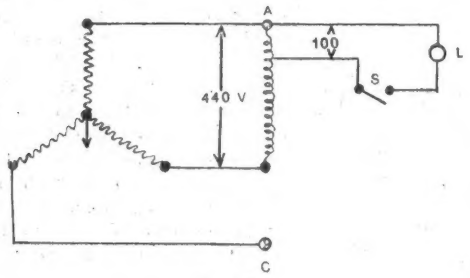


FIG. 3.

as Mr. Ram pointed out, it is not possible by means of a single-pole switch to disconnect the lamp terminals from the 440-volt mains, although, as mentioned above, it is difficult to understand how a P.D. of 440 volts was shown between the terminal and earth; one would suppose the P.D. to be about 250 volts assuming the neutral point of the system to be earthed. It is open to question whether or not such an installation as this should be allowed at all under the regulations, because, quite apart from the question of holders and portable hand-lamps, it is possible for an attendant to receive a serious shock from an *ordinary* lampholder or metal shade connected thereto, when taking out or replacing a lamp. Unless, therefore, the holders are either earthed or shielded, the installation does not comply with the following requirement:—

"Where necessary to prevent danger, adequate precautions shall be taken either by earthing or by other suitable means to prevent any metal other than the conductor from becoming electrically charged."

Then as regards switch lampholders, there are patterns on the market provided with insulating covers which are supposed to meet all the regulations, and to outward appearances do so, but in some of them it is possible when metal shades are employed, as is quite common practice in factory work, for the shade to make contact with the metal body of the holder, and in this way quite neutralise the purpose of the insulating sheath. (See fig. 5.)

To revert to the question of acquaintance with the law, and in particular with the Home Office requirements, it

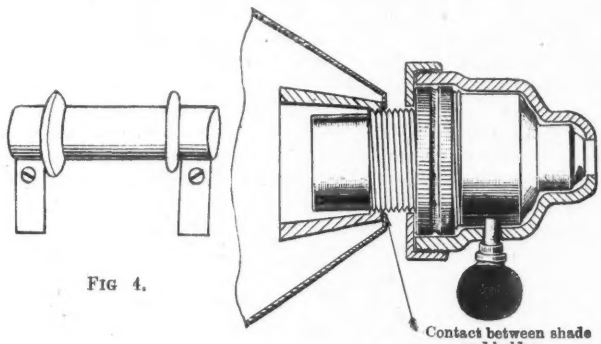


FIG 4.

FIG. 5.

appears to be the case that many electrical manufacturers and contractors have only a very superficial acquaintance with them. If this were not so we should not find some of our leading manufacturers advertising for sale "Home Office pattern fitttings," which are clearly not at all in conformity with the regulations. Take, for instance, the question of fuses; how often do we see the porcelain bobbin type of fuse with unprotected ends, such as is shown in fig. 4, advertised either as complying with Home Office requirements, or as suitable for power installations in factories, which is the same thing, when an examination of the rules would show that such a type is distinctly prohibited? Bearing on this, part of Regulation 5 reads as follows:—"Every fuse shall be either of such construction or so protected by a switch that the fusible metal may be readily renewed without danger." A fuse of the type shown cannot be handled without the risk of touching the live end to which the fuse wire is connected. The ordinary method of handling would be to grasp the porcelain tube in the hand and touch the live end with the thumb, whilst the other hand is resting on the earthed metal case.

Not only do we find this type of fuse advertised as meeting all Home Office requirements, but it is repeatedly put forward by reputable contractors as a sample of the kind of thing they intend to use, and they seem quite amazed to learn that such samples do not comply with the Home Office conditions.

Even when manufacturers appreciate that a fuse handle should entirely shield the live contacts of the fuse, they frequently overlook the fact that metal fuse cases have to be earthed and made continuous with the conduits carrying the cables. The consequence is that a number of excellently-designed fuses are now enclosed in cast-iron cases, which are split across the centre of the cable inlet, the latter being provided with porcelain insulators to insulate the wire from the case. This is a most unsuitable type of fuse-box for a continuous piping installation, as it means that the pipes must be cut off and bushed on both sides of the fuse-box and short lengths of cable exposed between them. The fuse boxes and pipes must then be bonded together by means of an earthing wire, which may at any time be disconnected for testing and left adrift, so destroying the continuity of the piping system, and at the best it is a patchwork job.

Again, as regards enclosed switches, a large number of enclosed switches on the market have an open slot in the cover through which the switch handle operates. This is quite commonly supposed to fulfil all the requirements of the Home Office Regulations, but it is more than doubtful that it does so, as it is by no means impossible for an operator to

receive a shock or burn in operating such a switch. This remark applies not only to the ordinary type of D.P. switch, but to motor-starting switches, a large number of which are provided with an open slot in the cover immediately facing the sliding resistance contacts.

The foregoing are but a few of the points to which attention might be drawn, but they are sufficient to show that there is still a great lack of appreciation on the part of manufacturers and contractors of the conditions to be fulfilled in factory work in order to fully comply with the Home Office requirements. This makes it exceedingly difficult for those whose business it is to plan and supervise such work to ensure that the conditions are fulfilled without their being stigmatised as faddists or cranks.

CORRESPONDENCE.

Letters received by us after 5 P.M. ON TUESDAY *cannot appear until the following week. Correspondents should forward their communications at the earliest possible moment. No letter can be published unless we have the writer's name and address in our possession.*

Antipodean Views.

I have read with interest in your issue of October 17th, under the heading of "Antipodean Views," a *résumé* of the impressions of an Englishman visiting Australia, and an Australian visiting Europe, and there are one or two matters which call for comment.

Mr. Justus Eck, whom I had the pleasure of meeting when he was here, mentions that "the Fire Underwriters' Associations when bringing in a fresh set of Electrical Rules do not permit of stocks under order, and in course of delivery being used." Such a condition of things would, as you rightly say, be a real hardship if it existed, but Mr. Eck has been wrongly advised on this matter.

The Federal Council of Underwriters (which body controls all matters, such as rules, throughout Australia) has for some years past adopted as its standard the British I.E.E. Rules with the addition of a few clauses to provide for local conditions.

Invariably a new edition is not adopted for at least six months after being issued by the British Institution, and then the rules do not come into operation for at least three months, which time is very often extended, after the date of issue. Importers, therefore, have plenty of time to get rid of existing stocks and stocks under order.

I notice that in commenting upon my contribution to the discussion upon Mr. Westwood's paper before the Victorian I.E.E., you say that my view regarding the use of railless trolley 'buses appears to be fallacious. I think your knowledge of Australian conditions and Australian roads is not very good.

Railless electric cars have not yet been tried in Victoria, and I do not think in Australia, but motor-'buses have, and are increasing in number within the city of Melbourne. As is well known, the surface of the streets in Melbourne is excellent; but in the suburbs, more especially those in the outer area, the roads, as a whole, are bad, and far too bad for 'buses or railless cars to run upon with any degree of comfort to the passengers.

Some time ago two lines of motor-'buses were put on in one of the suburbs; these cars ran for some time, but were unpopular. There was no appreciable increase in the traffic from month to month, the district did not go ahead, and the property valuations were not enhanced. Since then, upon both the routes where the motor-'buses were running, electric tramways have been built. From the time the rails were put on the road, settlement increased, the district went ahead by leaps and bounds, and property valuations went up. This improvement was marked even before the track was completed.

What has been the result of laying rails in the Caulfield district? From the time the electric tramway construction commenced the activity in building operations has been without parallel, certainly in any part of Victoria, and probably any part of Australia, and property values have increased probably 50 per cent.

The above facts seem to me to indicate that a railless system of traction is regarded as "portable," and too easily moved from one place to the other, so giving no permanence to the service; whilst, on the other hand, if the rails are nailed to the road, the general public regards the system with its resulting conveniences as being permanent, and so settles down to live in parts well out from the metropolis, and in parts that would be impossible residential areas without a fast and comfortable means of getting into the city.

Noel Murray.

Melbourne, *November 18th*, 1913.

The Lighting of Churches.

I should like to call attention to the very unsatisfactory way in which the electric light has been installed in many churches.

In some the lights are so high up that it is not easy to see average print; in others, it would seem as if when metallic-filament replaced carbon lamps the old shades were retained, the result being, as in a church I attended last Sunday, that fully half the filament is visible. It is well understood that this is bad for the eyes, yet there is no escape from it in one fitting or another.

In some churches lamps are simply strung round the columns, pointing up or down as taste directed, with no shades or screen of any kind; elsewhere iron rods stick out 4 or 5 ft. from the wall and slender cords carry pendants with three or more lights, often again without shades, or if with shades, they are very open ones.

The choir in many churches (including St. Paul's) looks like a bank with its rows of green shades, utterly out of place. I grant that the question is not an easy one in many churches, but I think better results could be obtained with a little thought and a little less reliance on the contractor, who, after all, is put in competition and naturally wants to get the work rather than to achieve an artistic result.

In new installations I would urge the full consideration of the best scheme suited to the building and invite tenders on the result; meanwhile, I would ask that lamps where the filament is seen should be replaced by obscured or semi-obscured ones.

P. Benham, A.M.Inst.C.E.

London, E.C.

Lead.

An article in your last issue under the above heading reflects a little, we are quite sure unintentionally, on statements made in our weekly "Lead Report," which you have so kindly inserted in your valuable paper.

We refer to the following remark made by the writer of the said article. "There have been rumours about of heavy quantities of lead arriving . . . . but the apprehension on this score proved to be overdrawn."

We beg to point out that from November 1st to December 15th, no less than 20,000 tons (in round numbers) arrived in the Thames, whereas in the five previous months, June to October inclusive, the total arrivals were under 47,000 tons, which conclusively proves the correctness of our statements. The result is shown by the fact that lead, which on November 10th was £20 10s. per ton, is now nearly £3 per ton lower.

Jas. Forster & Co.

London, E.C., *December 23rd*, 1913.

[Our correspondents have apparently misread our comments. The quotation given above omits an important clause. It should read: "There have been rumours about of heavy quantities of lead arriving; and *of substantial lots being put into warehouse*, but the apprehensions on this score proved to have been overdrawn." Later, in our leaderette, we remarked: "Although the arrivals of lead in London have recently been quite heavy, all the metal which came to hand was taken up easily."—EDS. E.R.]

"Rodolite" Heating Elements.

Our attention has been drawn to the letter on this subject in your current issue, and we beg to say that the references cited by your correspondents describe heating elements which differ in all essential details from our "Rodolite" glowers.

If your correspondents will publish details of the heating elements, which they say they have been using for some years, we think we shall be able to point out to them wherein the difference lies, as compared with "Rodolite" glowers, but we warn them beforehand that we are not going to be drawn into a controversy in your columns as to the respective merits or demerits of Bastian "Rodolite" glowers and these alleged similar heaters manufactured by some unknown maker.

We made a heating element of this same type ourselves early in 1910, and sold a few that year, but it is only within the last few months that we have been able to add those necessary finishing touches that go so far in differentiating between the interesting experiment and the commercial product of practical utility.

The Bastian Electric Heating Syndicate, Ltd.

C. Orme Bastian, *General Manager.*

London, W., *December 30th*, 1913.

Small Electric Light and Power Undertakings.

Being interested in this subject I have read Mr. H. P. Girling's article *re* the electric supply system which he has carried out at Barton-on-Humber with particular interest.

The arrangement of such installations is, in my opinion, well worth discussing, and I should therefore like to make a few friendly criticisms.

The value of Mr. Girling's article would, I venture to think, have been considerably enhanced had he given figures regarding the capital expenditure upon the component parts of the installation, including buildings, plant, battery, mains, &c.

The adoption of suction gas plant is interesting, and details as to cost of fuel, consumption per unit generated and load factor would have been of interest. There are, of course, plenty of makers' test figures available, but figures extending over a considerable period, giving fuel consumption over varying loads and including stand-by losses, are the only ones of material value. Many engineers who, like myself, are using Diesel engines, would appreciate working results obtained in this way. The results obtained with Diesel engines are, under normal circumstances, good and consistent, but, owing to the fact that the supply of fuel oil is at present practically a monopoly, and that perhaps after spending some thousands of pounds on such plant, one may be called upon to pay a prohibitive price for fuel, it is certainly desirable to obtain all the data possible concerning internal combustion plant which is not dependent upon one source for a supply of fuel.

As regards systems of supply, this is, of course, largely governed by local circumstances. The key-note, however, should be simplicity, and, bearing this point in mind, a slight additional capital expenditure may, in many cases, be warranted to secure that end. Under such circumstances the adoption of the simple two-wire system would do much to secure simplicity and reliability of operation. Such a system, with the negative pole earthed through suitable indicating and isolating devices would be extremely reliable as, should an incipient fault develop, it would become apparent at once and could be isolated and removed before serious trouble ensued.

The use of overhead work is certainly justified in rural districts, but in places where a number of services are required within a circumscribed area it is often complicated and unsightly, and the service lines themselves may cause considerable trouble. In order to avoid this it is sometimes the practice to run underground services from the nearest pole. This may, however, if carried out on an extensive scale, become expensive, the total cost being perhaps nearly as great as an underground system of distributors. Where overhead work is desirable it should be erected in a permanent manner, and it is suggested that if ordinary standard tramway insulators and trolley were used, a very satisfactory system could be erected. The difficulty of connecting new services to live mains is more apparent than real, particularly if two or three-core distributor is laid; while good modern cable, properly laid and protected, should be entirely immune from faults.

The provision of an engineer's residence adjacent to the works is very desirable. In such cases the engineer's residence should form the showroom, and if his kitchen is electrically equipped, prospective consumers could see electrical cooking carried out under practical conditions, and, if the engineer himself has a "well-fed appearance," he would constitute a walking advertisement for electrical culinary processes! The company would, of course, consider the latter point in fixing the engineer's salary.

In conclusion, I should like to congratulate Mr. Girling upon his method of starting up his gas engines, which, I am sure, is a considerable improvement upon the ordinary method of taking the starting current at full pressure from the station bus-bars.

Wm. J. U. Sowter.

Bray Electricity Works, *December 23rd*, 1913.

The Position of Railway Electrical Staffs.

During the past month the charge engineers in the various sub-stations on the Metropolitan Railway have been receiving leaflets from the A.S.R.S., who appear anxious to enrol them as members, and the argument on which they base their appeal is certainly sensible: also, they can see that by having the electrical staff on their side they gain a good point. If, during the last railway strike the electrical staff had gone out, this line, in particular, would have closed down for a certain time, but as it was, the electrical staff remained at their posts, and some did duty as drivers on the trains, and the drivers saw that without the electrical staff's co-operation their part of the work was very little affected.

Now as to the necessity of joining up with the A.S.R.S. At the present time we are classed with the uniform staff, but as we do not belong to the Society, we have no remedy for any grievance which may occur.

I should think it would be to the advantage of the company to place the electrical staff on the permanent staff, so that we should feel we were receiving some recognition of our existence in the scheme of the running of the Metropolitan Railway. At the present time no notice is taken of any petition we forward to the powers that be.

The majority of the staff agree that the A.S.R.S. have got us in our weak spot, and we cannot dispute their argument as stated, that we are treated as non-existent.

It now remains with the whole of the electrical staff to consider their position, and whether it would not be to their advantage to join up with the A.S.R.S., and so give what help they can to their brothers of the uniform staff.

Nemo.

Co-operative Electricity Supply.

During the leisure of the holidays, I have been much interested in Mr. Seabrook's letter on the above subject.

I am amazed to find such fallacious criticism of Mr. Chattock's proposals from one who has shown in his recent lectures that he holds quite sensible views on some of the minutiæ of business enterprise.

It seems as if the kinetics of his personality are a little uncontrolled when he enters the field of broad generalisation. He evidently thinks that the epithet of Socialism or Communism (which he incorrectly uses as a synonym) is crushing and final when applied to a proposal in itself sane and reasonable. A definition of this kind may influence a nervous old lady, but a thoughtful business man, above all an engineer, should not be alarmed, even if an attempt be made to identify a progressive policy with a word of traditional, if unmerited, opprobrium.

The proposition to nationalise the production of electric energy is not novel to those who follow the progress of modern thought, to even a limited extent.

Mr. Seabrook's fallacy is quite transparent in his apparently reasoned consequences from such unsupported asser-

tions as, that nationalisation connotes "extinction of individual initiative," or that it connotes the negation of "working for reward in some shape or form."

Again, Mr. Chattock's argument was not that "because railways should be nationalised so ought electric supply." He associates the proposals as desirable, and says rightly that there is justification for considering both of them.

Mr. Seabrook's logic, with immense agility, overrides all argument, and without a vestige of proof states the direct negative!

His illustration in doubtful support of nationalised railways is singular. Does a man of his business experience suggest that military requirements should influence our ordinary railway administration more than they do to-day? If so, unlike the normal business man he attaches undue importance to risks that are remotely improbable.

I am glad to find one statement in Mr. Seabrook's letter that displays an intelligent anticipation of Social advancement. He says: "I believe strongly in altruism in business"; yes, I agree. The only obstacles to its speedier development are inertia and ignorance of what it implies.

The answer to Mr. Seabrook's fears of nationalisation may best be given in the words of Mr. H. G. Wells. Concerning the ideal State of the future, he says: "Whatever other types of property may exist, all natural sources of power, and, indeed, all natural products, coal, water, and the like, are inalienably vested in the local authorities, which will be the universal landowners and will probably control areas as large sometimes as half England. They will generate electricity by water power, by combustion, by wind or tide, or whatever other natural force is available, and this electricity will be devoted, some of it to the authority's lighting, and other public works, some of it as a subsidy to the world State authority, which controls the great railways and other apparatus of world communication, and the rest will pass on to distributing companies at a uniform fixed rate for lighting, heating and industrial purposes." The value of this ideal will be apparent to any thoughtful engineer. The conservation of the exhaustible natural resources of power, such as fuel, and the administration of the natural monopoly created by the establishment of the "universal-electric" age (in which we all believe) must desirably be undertaken by the State.

I hope Mr. Seabrook overlooks the question of land ownership, referred to in the quotation above, lest he should conjure up from it seven devils worse than the one of nationalised electricity. I have no doubt, however, that he would cheerfully proceed to exorcise them with the same facility and heartiness as he exemplifies with the bogey he has constructed out of Mr. Chattock's proposal.

Alban.

December 29th, 1913.

[Other correspondents who wish to express their views on this matter are requested to keep strictly to the subject, as we cannot afford space for a discussion on the merits of Socialism or Communism *per se*.—Eds. Elec. Rev.]

Electric Clocks.

Your correspondents appear to admit the truth of the Synchronome principles and that they have never been attacked. The difference of opinion is as to how far they may be ignored.

The champions of the two systems which transgress most of them give some plausible excuse with respect to one item, viz., the storage of power into a pendulum by the Hipp-Foucault method, and taking it out in contact-making energy. Their justification of this is attempted only with respect to time-keeping for ordinary purposes, and it cannot be too clearly understood by all those who seek for the highest precision of time measurement that such tricks cannot be played with a pendulum with impunity. The resulting errors would altogether submerge numerous refinements of astronomical observatory clocks, such as barometric compensation. I admit that these considerations do not apply to commercial purposes. The other matters I named are of more importance.

The community owe much to all who are exploiting simple systems of electrical impulse dials, and we cannot have too many if they are reasonably accurate and reliable. But it is just 75 years since the first system appeared, and a critical comparative survey of the hundreds of inventions produced in that period, mostly blunders, rubs in the lesson that only those which keep the rules can hope to survive.

Time is the only test of systems of time-keeping, and this reflection should put heart into all those who are striving to sell the best science with simple and reliable systems at the lowest possible price.

F. Hope-Jones, M.I.E.E.

London, W.,
December 29th, 1913.

Concerning a Review.

After reading your reviewer's reply to my complaint, I am no longer surprised at the nature of the review.

I made no complaint about the size of the book at the price, nor did I say that I bought it on the strength of a review. It is small justification for the reviewer to say in answer to my letter: "You cannot expect much for a shilling," and to point to another review as careless as his own. I was quite unaware that such are the lines reviewers work on.

The errors in the book are neither few nor, for anyone not thoroughly familiar with the plant, &c., illustrated in the diagrams, easy of correction. If the incorrect and misleading parts of the book are eliminated from the contents, the proportion of reliable matter remaining will be far below the usual.

I am not familiar with the courses of instruction in kindergarten schools; perhaps it is in such institutions that the seeds are sown of that carelessness and inattention to detail which are sometimes displayed in reviews.

The last paragraph but one of my last letter is only plain spoken. Is not the phrase "gratuitous insult" becoming hackneyed through continued use by people who object to have their errors pointed out to them?

I do not see why it should be a novelty for a buyer to criticise a review. As I said before, I take it that reviews are written for their guidance, not for the edification or otherwise of the authors.

R. Rankin.

Ilford, *December 29th*, 1913.

Association of Mining Electrical Engineers.

With respect to the correspondence in your columns on the above, I had not intended to associate myself with it, but as you make allusions to your view being backed up by one of those connected with the Association in its infancy, and who is now a leading official of one of the branches, I must take this opportunity of assuring those of your readers who are members of the above Association that I, personally, am not the person referred to, as I happen to fill the bill in both cases.

Referring to the notes by "F. W. A." (December 19th, 1913), he evidently seems imbued with a peak-load of self-conceit in his remark that there is not a member of "that illustrious body in a position" to "slate" your review, and further, if what he says in his second paragraph *is* correct, I am sorry for his short memory as to the subscription fees.

His principles, like those of his fellow commercial, must be of very low insulation value to take advantage of the lack of technical knowledge of his customers, no matter who they may be. He certainly does well to conclude his remarks under initials, and, like "Nemo, London," seek to hide himself, like the little boys who hide round the corners when snowballing.

J. Glynn Williams.

Cwmgwrach.

Smoke Nuisance.—The Guildford Electricity Supply Co., Ltd., was last month fined £3 in respect of black smoke nuisance, and was ordered to abate the nuisance within 14 days. Last June the company was fined £2 for a similar offence, and ordered to abate the nuisance, but, according to the Town Clerk, this order was not complied with. The present proceedings related to two days in November and two in December.

E

NEW ELECTRICAL DEVICES, FITTINGS AND PLANT.

An Alba Fitting.

The accompanying illustration (fig. 1) shows one of the Alba fittings which were specially designed by the British Thomson-Houston Co. for the Balham Palladium. This fitting, which is of Adams design, consists of a heavy chased corona suspended by four chains. Inside the corona is fixed a 16-in. Alba glass sphere, and from each of the arms depends a 6-in. ball. One 200-watt and

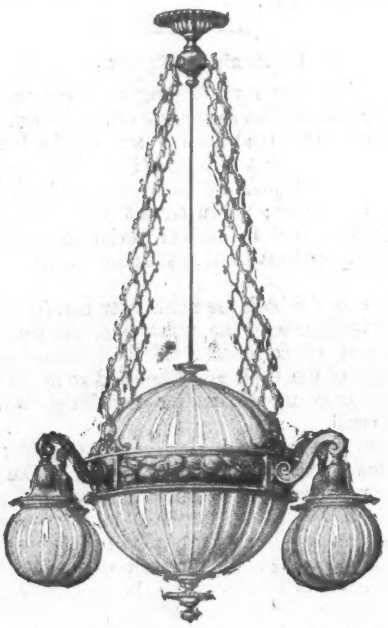


Fig. 1.—B.T.H. Alba Fitting, with Alba Glass Spheres and Mazda Lamps.

four 60-watt Mazda lamps are used in each fitting. The metal-work of the fitting is of polished brass; its overall length is 4 ft., and its diameter 2 ft. 6 in. It affords a good example of the combination of efficiency and beauty in the design of lighting appliances.

Portable Meter-Testing Resistance.

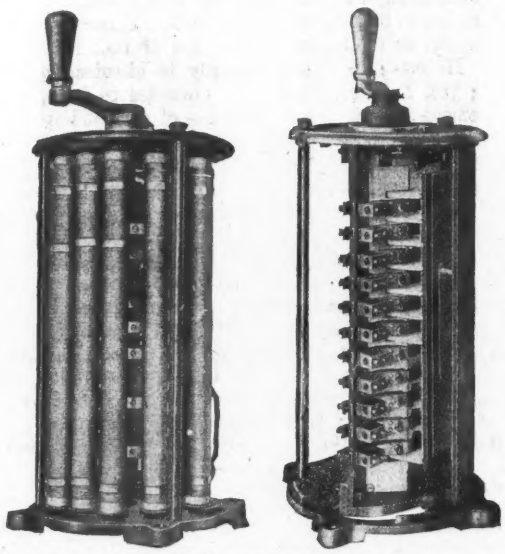
Since the introduction of low candle-power high-efficiency lamps, the importance of meter accuracy on small loads has increased greatly, and it is now a common practice to determine whether 8 or 10 watts will start a meter which, in the days of the carbon lamp, would have been considered quite satisfactory if it started at 30 or 35 watts. With a view to facilitating and rendering more accurate starting-load and light-load *in situ* tests on meters, Messrs. Ruhstrat Bros. (Göttingen) have placed on the market the pocket testing rheostat, illustrated in fig. 2. A suitable resistance—partly ballast and partly variable—is contained within a ventilated housing, on the top plate of which connecting terminals are provided. The resistance in circuit is varied by the central slider rod, the stem of which is calibrated to show the

Fig. 2.—Pocket Testing Rheostat.

watts consumption corresponding to various settings, assuming a supply voltage of 110 or 220 volts as the case may be. In the 10 to 100-watt rheostat, the ballast resistance is 500 ohms and the regulable resistance 2,000 ohms; and in the 5 to 50 watts and 2½ to 50 watts rheostats, the ballast resistance is 1,000 ohms and the regulable resistances 4,000 ohms and 8,000 ohms respectively. The resistances are designed for five minutes' continuous service, but are not damaged if left longer in service; the exact starting load (in watts) of a meter may be read from the slider stem, or the meter accuracy may be tested at any desired load within the range of the rheostat (which is connected across the special test terminals provided on modern meters). This apparatus, which is equally suitable for use with D.C. or A.C. meters, measures 6½ × 4¾ × 1½ in. overall and weighs about 1 lb.—*E.T.Z.*

G.E.C. Controller with Self-Contained Resistances.

For the purpose of controlling small cranes and for installing in situations where space is at a premium, The General Electric Co., Ltd., of Witton, and 67, Queen Victoria Street, E.C., &c., have designed a form of controller in which the resistances are contained inside the controller case itself. In general, it may be said that this controller is a miniature edition of the larger sizes of G.E.C. controller, with the exception that it includes the resistances. The controller is circular in plan, and the resistances are



Figs. 3 and 4.—G.E.C. Controller: Interior, with and without Resistances.

fixed inside the controller casing, well away from the arcing parts. They are carried on insulating tubes threaded on vertical steel conduits, which are insulated from the case by means of porcelain insulators. If desired, the resistances can be supplied separately, in which case they are mounted in a separate protected frame, which can be placed any distance away from the controller. The design of the controller, however, is such that the inclusion of the resistances inside the controller is thoroughly satisfactory.

"Meteor" Electric Sign.

A remarkable novelty in electric signs has been brought to our notice by the Meteor Manufacturing Co., of 98, Tollington Park, London, N. It consists simply of a sheet of plate glass, with the letters forming the announcement etched on the back

Fig. 5.—Meteor Electric Sign.

slightly below the surface; tube lamps at the top and bottom, contained within the tubular frame, illuminate the interior of the glass plate, and the light reflected from the rough surfaces of the

letters makes them shine out in a most striking and mysterious manner. The light passes into the plate through slits in the brass tubes, and is confined entirely to the substance of the plate. By using a white lamp at the top, and a ruby one at the bottom, a pleasant gradation of tints is produced, and if the lamps are connected to a flashing device a succession of varying colour effects results. The letters are bordered with black and gold, within which they appear white in daylight, the rest of the plate being quite transparent. The frame is of brass tube, with ornamental scrolls, producing a handsome appearance, and the signs are standardised in four sizes, with, of course, any lettering that may be desired. The lamps take only 17 watts each, so that the largest size, using six lamps, consumes 102 watts and the smallest 34 watts. Connection is made by a plug adapter and flexible with any bayonet socket. We understand that the sign, though only recently introduced, is already very popular, and certainly it is one of the best that we have seen as yet.

PHYSICAL SOCIETY EXHIBITION.

(*Continued from Vol. 73, page 1032.*)

ROBT. W. PAUL.

THIS exhibit included a number of new instruments, ranging over almost the whole field of electrical measurement. Among those for the accurate measurement of resistances, a simple form of Kelvin bridge suitable for measuring resistances from 1 ohm down to a few microhms may be described. Earlier forms of the Kelvin bridge were provided with high resistance ratios, each set being controlled by a plug switch. In the present instrument (fig 5) the resistance of the ratios is considerably reduced, so that higher sensitivity is attained, and they are connected to a double-pole switch, the pointer of which indicates directly the multiplier to be applied. The standard resistance consists of a slide-wire, with extensions connected to plug blocks; the slider is of novel construction, contact being made on the slide wire and on a copper rail by a copper roller, one end of which has a V-groove running on the slide wire, and the other a slightly curved contour running on the copper rail. On account of the difference in diameter of the two ends, a rubbing contact is obtained, a suitable pressure being applied by a spring in the slider. The Kelvin bridge, which is probably the best means known for measuring low resistances, such as those of copper bars or steel rails, and for standardising shunts, should come into more general use now that a convenient model is available.

A standard bridge, designed by Dr. C. V. Drysdale, for the comparison of standard resistances to one part in one million, and a modified Kelvin bridge, devised by Mr. S. W. Melsom, of the National Physical Laboratory, for the rapid comparison of ammeter shunts, were also shown.

In our notice of the last exhibition we described a resistance bridge in which the readings were given in a straight line of figures like those of a cyclometer dial; Mr. Paul has applied a similar

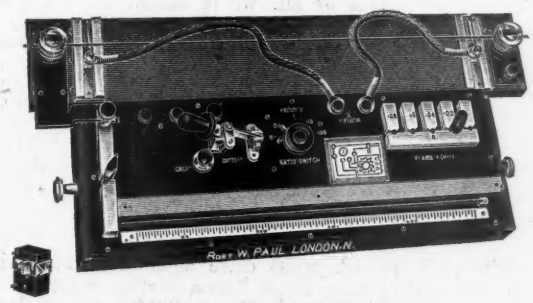


FIG. 5.—KELVIN BRIDGE.

system to the construction of a vernier potentiometer, in which no slide wire is used, the readings being given directly on a series of such dials. A simple portable potentiometer suitable for voltmeter calibration was also demonstrated (fig. 6). This potentiometer requires no accumulator or other external source of current, and reads directly in steps of 0·1 volt from 2 to 800 volts. A standard cell is contained in the potentiometer, and this very compact outfit is completed by a sensitive Unipivot galvanometer. The latter may take the form of a millivoltmeter, with shunts, so that ammeters as well as voltmeters can be standardised.

For alternating-current measurements, the Duddell-Mather wattmeter is a recognised standard. This instrument has been redesigned with a view to overcoming the small change in sensitivity caused in the earlier forms by the warmth of the current coils acting upon the control spring. The latter is now placed in a separate compartment, open to the outer air. One of these wattmeters, with plugboard, suitable for 1,000 amperes, was exhibited.

Portable sub-standard instruments of the Irwin astatic pattern were shown; these are entirely unaffected by external fields, and give remarkably dead-beat and quick indications.

We illustrate a frequency meter designed by Mr. L. W. Wild, of the Westminster Testing Laboratory (fig. 7). With this instrument, frequencies between 10 and 500 per second are read directly on a scale, instead of in steps. The indications are independent of voltage variations, provided they do not exceed ± 20 per cent. Two laminated magnets, respectively of high and low inductance, provide magnetic fields which tend to move an aluminium vane in opposite directions, the position of equilibrium depending on the frequency alone. A choking coil damps out any harmonics which may be present, and renders the instrument independent of variations of wave form.

Several new forms of Unipivot galvanometer were exhibited, including a modification in which an extremely high sensitivity is attained; pointer instruments are now constructed to give a full scale deflection for 5 microamperes or 0·3 millivolt.

Among instruments for radiotelegraphic measurements was an improved thermal device, consisting of a heater through which a

FIG. 6.—PORTABLE POTENTIOMETER.

high-frequency current can be passed, and ten thermo-junctions, the tips of which are near the heater. With this device, currents down to a small fraction of a milliampere are readily measured on a sensitive moving-coil galvanometer, and the errors, liable to occur in high-frequency measurements when using a thermo-junction in contact with the heater, are entirely eliminated. For telephonic measurements a convenient source of current has been devised, called a Kumagen, which can be adjusted to give any frequency from 80 to 2,000 periods per second, and an output sufficient for all ordinary measurements. This portable generator

FIG. 7.—FREQUENCY METER.

is at present in use, in connection with a modified form of Max Wien capacity bridge, for testing telephone cables after laying. Several improved patterns of fixed and variable condensers for oil or air dielectric were shown, included shielded types.

Thermocouples and resistance thermometers for measuring the temperature of electrical plant, superheaters and so forth, were shown in considerable variety.

A series of simple and robust instruments for the college laboratory have been produced. They include an improved form of magnetometer with air damping, together with accessories for putting the magnetometer to a variety of uses. An ingenious magnetic balance was demonstrated; it provides a simple means for determining the strength of a magnet pole, and thereafter measuring current in absolute units by the attraction on that pole. The instrument is so designed that the action is limited to one pole of each magnet, the complications introduced in the ordinary balance by the interaction of the remaining poles being entirely eliminated.

CROMPTON & CO., LTD.

In addition to a variety of small and large moving-coil and moving-iron instruments, portable testing sets, &c., Messrs. Crompton & Co. showed several new instruments. One of these was a portable voltmeter fitted in a strong oak case for portable use, with scale 6 in. long, and provided with a mirror for accurate reading. The movement is of the dead-beat moving-coil type, and is magnetically shielded. It is designed to give five ranges with a maximum of 600 volts, and is fitted with a switch by which the range may be changed. The switch contacts are contained inside the case, and are thus protected. A contact key is fitted, and also a zero-adjusting device operated from the outside.

A battery testing voltmeter was exhibited of the moving-coil type, dead beat, and of high resistance, in a case. The instrument

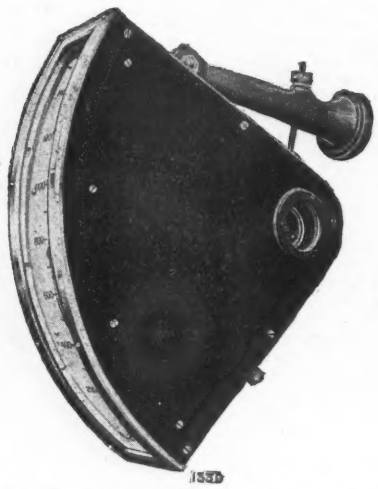


FIG. 8.—CROMPTON EDGEWISE AMMETER.

s fitted with a handle, and contact is made by means of two spikes, one fixed to the instrument, and one held in the hand and connected to the instrument by a flexible lead. A Crompton potentiometer complete, with a set of accessory apparatus, was shown.

We illustrate in fig. 8 one of the firm's edgewise D.C. switchboard instruments of the moving-coil type, with dead-beat action, magnetically shielded, and with an evenly divided scale. Moving-iron instruments of similar pattern are made, as well as round and sector types.

JOHN J. GRIFFIN & SONS, LTD.

The most noteworthy electrical feature of this exhibit was an electric hot-plate with automatic temperature regulation, for use in chemical laboratories. The plate is constructed of aluminium, which offers great resistance to acid fumes, and has a removable top which, when placed over the heating surface, forms a hot-air chamber about 2 in. deep. The heating elements are of a special flat design, made of nichrome foil, and the heating surface attains a maximum temperature of about 250° C. The temperature of the plate can be set at any desired degree up to this limit by turning a contact screw (*a* in fig. 10), the head of which is divided into five intervals each representing 10° C.; the brass tube *b* is

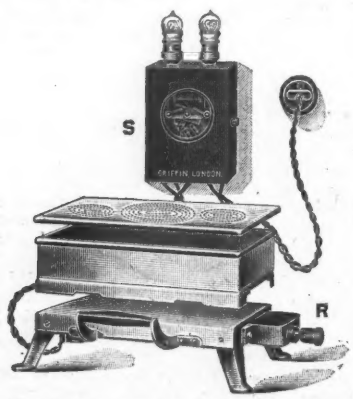


FIG. 9.—HOT-PLATE WITH AUTOMATIC TEMPERATURE REGULATION. R, REGULATOR; S, RELAY.

divided into five parts each corresponding to 50° C., and thus any desired temperature can be reproduced exactly when needed. The action of the regulator depends upon the difference in expansion between the hot-plate and a nickel-steel rod attached to it; the free end of the rod *h* engages with a disk *e*, which is pivoted about two short pins *g* attached to the hot-plate. A brass strip *d* fixed to the disk carries a platinum contact opposite the platinum-tipped point *c* of the regulating screw. When the plate expands contact is made between *c* and *d*, and a small current derived from the mains actuates a relay (seen in fig. 9), tipping a mercury switch which cuts off the heating current. When the plate cools so far that the contact is broken, the heating current is restored. By this system of control the temperature is kept very uniform, the regulator being independent of fluctuations in the voltage of the supply and of atmospheric conditions; and no

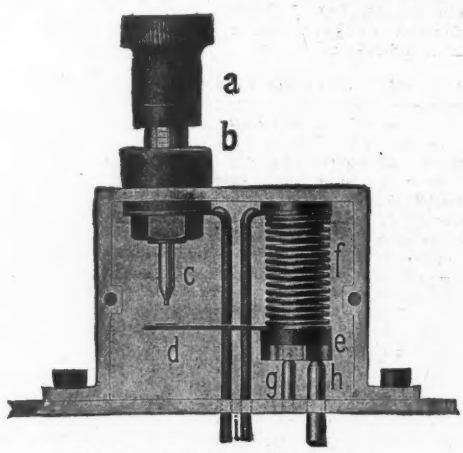


FIG. 10.—DETAILS OF REGULATOR.

part of the electrical energy is wasted in regulating resistances. The mercury switch is made of quartz glass, and the relay current is very small, so that the platinum points are not burned by the make and break. Signal lamps are provided to show what is going on.

THE SYNCHRONOME CO., LTD.

The Synchronome system of electric clocks was represented, as usual, by a large group of electrical impulse dials, operated every half-minute by a self-wound electrical time transmitter. In recent years the Synchronome Co., Ltd., under the general direction of Mr. Hope-Jones, has aimed at the attainment of the most accurate time measurement, and the electrically-driven pendulum exhibited was one of their latest astronomical regulators, enclosed in a glass cylinder between substantial iron castings. The ordinary high-grade Observatory clock of to-day has contacts applied to its pendulum, or to its delicate wheelwork, for the purpose of operating chronographs, &c. These are apt to be unreliable, and are detrimental to good time-keeping. Moreover, such clocks have to be wound up weekly, and where the case is really air-tight, in order to elude the barometric error, a stuffing-box is necessary for the winding-key.

These difficulties are overcome in the instrument exhibited. The Synchronome self-winding action is in the form of the "Inertia" escapement of Mr. W. H. Shortt, and the clock combines the advantages of a precision timekeeper with a switching operation which can be absolutely relied upon for the synchronous propulsion of secondary dials.

(*To be continued.*)

BUSINESS NOTES.

Whist Drive.—A whist drive and dance was held last week at the Bentley Parish Rooms, Bentley, in connection with the Football Club of Messrs. Rhodes Motors, Ltd., of Bentley. Prizes were given by Mr. Axeworth (manager), Mr. Pearson (stores manager), Mr. J. Codd, Mr. H. Nelson, and members of the team. Mr. H. Mason acted as M.C. at the whist drive, and, along with Mr. H. Gascoigne, fulfilled the same duties at the dance.

Bankruptcy Proceedings. — FRANK WEST SUTER, electrical and general engineer, residing at 67, St. John's Park, Upper Holloway.—Under a receiving order the first meeting of creditors was held on Tuesday at the London Bankruptcy Court. Mr. Egerton S. Grey, Official Receiver, reported that the debtor had lodged a statement of affairs showing unsecured liabilities £6,417, and no assets whatever. It appeared from the debtor's statements that he commenced business some 23 years ago in partnership with another person as electrical and general engineers at 276, Strand, W.C., removing later to 66, Berners Street, W. In 1895 they sold the business to a limited liability company, of which the debtor acted as managing director at a salary reaching a maximum of £350 per annum. Some years ago, on the sale of the company's business, the debtor was held to be liable for £6,175 under guarantees given by him to certain of the debenture-holders; those liabilities constituted his present indebtedness, and to them the failure was entirely ascribed. He was now in employment. In the absence of any proposal the case was left in the hands of the Official Receiver, to be wound up in bankruptcy.

W. H. DAVIS (lately trading as the General Incandescent Fittings Co.), Birmingham.—January 7th, 1914, is the last day for the receipt of proofs for dividend by the Official Receiver, Mr. A. S. Cully, Ruskin Chambers, 191, Corporation Street, Birmingham.

CHAS. BLAKE (trading as the Bilston Electrical Co.), electrical engineer, Bilston, Stafford.—First meeting was held December 31st, 1913, at the Official Receiver's office, 30, Lichfield Street, Wolverhampton; public examination takes place on January 21st, at the County Court, Wolverhampton.

WAKELIN BROS., LTD., 7, Tottenham Street, W.C.—A first and final dividend of 7½d. in the £ was payable December 31st, at 3, Fenchurch Street, E.C.

Water Softener Firms Amalgamate.—It is announced that arrangements have been concluded under which the two concerns of Lassen & Hjort, and Water Softeners, Ltd., will henceforth operate in the British Isles as a joint concern under the title of UNITED WATER SOFTENERS, LTD. Messrs. Lassen & Hjort are the patentees of a system of softening water by means of lime and soda, whilst Messrs. Water Softeners, Ltd., are the proprietors of the recently introduced "Permutit" regenerative process. The two processes are, in a very large number of cases, essential complements one of the other in order to secure the best results. The management of the new company will be in precisely the same hands as was that of the two original concerns, and pending the acquisition of new and more commodious offices, in which both staffs will be brought together under one roof, the business of the new company will be carried on jointly at the existing offices of the two concerns.

Australian Contract Specifications.—The Commercial Intelligence Branch of the Board of Trade has received from the office of the High Commissioner in London for the Commonwealth of Australia, copies of standard specifications for certain supplies which may from time to time be required by the Commonwealth Postmaster-General's Department, as follows:—Tinned copper wire, rubber-insulated and braided (Specification No. 486); tinned copper wire, silk insulated and cotton-covered (Specification No. 487); portable direct-coupled internal combustion engine and dynamo (Specification No. 489); galvanised iron cable terminal (Specification No. 491); electric clocks (Specification No. 492); cast-iron cable distributing box (Specification No. 493); paper-insulated lead-covered cable (Specification No. 494). These specifications may be seen by United Kingdom manufacturers at the C.I. Branch of the Board of Trade, 73, Basinghall Street, London, E.C.—*Board of Trade Journal.*

Theatre Installations.—At the new Golder's Green Hippodrome, which was opened on Boxing Day, MESSRS. T. W. VAUGHAN & CO., LTD., of Islington, carried out the whole of the electric lighting work, including the stage, battens, transformers, motor generator, &c., also the fireproof curtain, fire hydrant, &c. The same firm have lately carried out cinema electrical installations at Hither Green, Wood Green, and several other places.

Catalogues and Lists.—MESSRS. MANLEY & SANDY, LTD., Caledonia Street, King's Cross, London.—8-page list illustrating the M. & S. miners' patent electric gas detector safety lamp, also equipments for lamp cabins.

MESSRS. BEST & LLOYD, LTD., Cambray Works, Handsworth, Birmingham.—List No. 106 describes and gives prices of the "Robj" cigar lighter and pillar lamp combined.

THE ELECTRICAL SUPPLIES CO., 41, Cheapside, London, E.C.—New net trade and export price leaflet of wires and cables, bell wires, flexible cords, &c.

MESSRS. T. W. BROADBENT, LTD., East Parade, Huddersfield.—New leaflet dealing with, and giving prices of, direct-coupled continuous-current generators of sizes ranging from 100 up to 500 KW. Copies will be sent on application.

Annual Dinners.—The Telac 20 Club, in connection with the officials of Messrs. J. H. Tucker & Co., electrical accessories manufacturers, Birmingham, held their second annual dinner at Ye Olde Royal Hotel. The president, Mr. J. H. Tucker, was in the chair, and in replying to the toast of "Our President," he expressed his appreciation of the objects of the club, and his wishes for its continued success. A smoking concert, arranged by Mr. H. Rodgers, followed, in which the following artistes were enthusiastically received:—Miss Evelyn Hollister, Mr. William Gumbley, Mr. Frank Knight, Mr. Arthur Riches, Mr. Gordon H. Haines. The menu card was cleverly designed by Mr. J. A. Crabtree, and the general arrangements were carried out by Mr. A. O. Davis, the hon. secretary.

The annual staff dinner of the Musselburgh and District Tramways Co. was held on December 22nd, Mr. C. W. Bentley, resident engineer and tramway manager, presiding over a company numbering 40. Those present included Bailie Constable and Mr. Watson, the commercial manager. Mr. Bentley read a letter from Mr. Cownie, a director of the company, and he followed with references to the Staff Recreation Club. Bailie Constable proposed the toast, "The Company," and Mr. Robb, electrician, seconded, Mr. Watson responding. A musical programme followed.

On Saturday, December 20th, Mr. Duncan Watson presided at the annual dinner of his firm—Duncan Watson & Co., of Berners Street, W.—held at the Frascati. Some 120 gentlemen were present, including Alderman Penton, ex-Mayor of Marylebone, Councillor Captain Ramsden, the borough electrical engineers of Poplar, Hackney and Hampstead, &c. In proposing the toast, "Staff and Employés," Mr. Watson took advantage of the opportunity of giving an imposing list of electrical installation contracts that had been carried out during the year for lords and ladies, mansions and missions, churches and picture theatres, hospitals and warehouses. Mr. Pulver replied on behalf of the staff, and Mr. Rawlinson for the men. The latter alluded to the "little trouble in the electrical world with regard to Trade Unionism," hoping that it would terminate to the satisfaction of all concerned. He referred also to the fact that the firm had always paid the full recognised rate of wages, and said that employment under Mr. Watson was congenial, many of the men present having been with the firm for 10 or more years out of the 18 of its existence. Mr. Blythem, chief-of-staff, proposed "The Visitors," and three gentlemen having replied, Alderman Penton proposed "The Chairman." This was received with great heartiness. The proceedings were interspersed with music and song.

Lead in 1913.—In the course of their report on the movements in lead during the year 1913, MESSRS. JAMES FORSTER AND CO. say that the continued scarcity which has run over nearly two years has been due entirely to the great consumption of lead for electrical work all over the world, which year by year increases, and which undoubtedly will increase for a long time to come. "The 'boom' in electrical consumption appears to have exhausted itself for the time being, and the reports from America and Germany are to the effect that of late there has been a considerable falling off in trade, with a consequent easing of the position, which is exemplified in a very considerable increase in arrivals on this market. . . . . The future of the market depends largely on the requirements of the electrical trade, and we have little doubt that after a period of dulness of probably limited duration we shall have a renewal of activity."

Trade Announcements.—MESSRS. GEORGE ELLISON, of Birmingham, announce that they have opened a branch office at 4, Cannon Street, Manchester, to deal with their Lancashire and Yorkshire business. The branch will be under the management of Mr. W. A. Kirkham, who will have at his disposal a staff of assistants capable of dealing with any inquiries for switchgear in these areas. To relieve the pressure on the estimating staff at the Birmingham head offices, clients in the two counties referred to are asked to forward their inquiries to the branch office.

Premises at 2, Chester Road, Macclesfield, have been opened by MESSRS. J. H. RIGBY & CO., electrical engineers and contractors.

During January MESSRS. NALDER BROS. & THOMPSON, LTD., will be moving into much larger works at 97A, Dalston Lane, Dalston, N.E., which they are fitting out on up-to-date lines. The works are within easy access of the city, only five minutes' walk from Dalston station on the N.L. Railway.

Mr. H. G. W. Haslett, who has been connected with the electrical trade for the last 15 years, a considerable portion of the time being with Messrs. Krupka & Jacoby, Ltd., informs us that he has entered into partnership with MESSRS. RALPH H. HAYLOCK & SON, mechanical and electrical engineers, 63, Queen Victoria Street, E.C.

THE BRITISH ECONOMICAL LAMP CO., LTD., have removed from 9, Old Bailey, to Windsor House, Kingsway, W.C., where they have taken ground floor and basement premises. The showroom of electrical fittings and accessories will be ready in a few days for inspection by the trade.

Book Notices. — Hazell's Annual, 1914. London: Hazell, Watson & Viney, Ltd. 3s. 6d. net.—This hardy annual has now reached its twenty-ninth edition. Its front cover describes it as "the one book of reference indispensable for every one." Its contents have been revised to November 25th, and under the editorship of Mr. T. A. Ingram, M.A., &c., every effort has been made to ensure its being a faithful record of the movements of the time. Our own experience is that we are so intent on living that we soon forget many of the important events even of a year, and it is only in preparing or reading reviews of such a period that one gets anything like a true idea of how much happens in a little time. *Hazell* is a summary of the present position of all sorts of subjects—religious, social, scientific, industrial, political and so forth. There is a review of "Engineering Schemes and Problems in 1913," and the usual section on electric supply—(a printer's error gives the Willesden station the first *Ljanstrom* (!) turbine put down in this country)—while we also casually notice one on cables and wireless telegraphy, including a map of the Imperial wireless scheme.

Whitaker's Almanack, 1914. 2s. 6d.; and *Whitaker's Peerage, Baronetage, Knightage and Companionage*, 1914. 5s. London: J. Whitaker & Sons, Ltd.—None of us can afford to be long without our *Whitaker* at hand. It has made a place for itself that no other work can fill. For the reader it is sufficient to be informed that the new edition of the work is "out" and that many of the sections have been extended and new ones added, the latter including the provisions of the Home Rule Bill and an article on Cable and Wireless Telegraphy. The second of these volumes, the *Peerage*, is alphabetically arranged throughout, and is a most useful volume for all who ever have to search for information respecting those upon whom birth or bestowed honours have conferred titular distinction.

Gas Works Directory and Statistics, 1913-14. London: Hazell, Watson & Viney, Ltd. 10s. 6d. net.—This directory, which was issued two or three months ago, and should have been reviewed before, has been revised up to August, 1913. It contains information, in a useful form, respecting gas works at home and abroad, and a general index of officials connected therewith.

Colliery Manager's Pocket-Book, Almanac and Diary for 1914. Edited by H. Greenwell. London: *Colliery Guardian* Co., Ltd. Price 2s.—This, the forty-fifth edition of this annual, contains the whole of the numerous Acts and Regulations relating to British coal-mining, accompanied by a host of statistics and data on all subjects that come within the manager's purview. Apart from the official

regulations and memoranda, only a few pages are devoted to electrical notes, and in view of the important part played by electricity in the colliery nowadays, this section appears to us to be quite inadequate. As the manager is the official responsible to the law for the efficiency of the electrical department, we imagine that he will need a great deal more information on the subject than is here provided, though the rest of the book is an almost inexhaustible store of useful information.

"*Journal* of the Institution of Municipal Engineers." Vol. V, No. 18. November, 1913. London: The Institution. Price 1s.

"*Journal* of the United States Artillery." Vol. XL, No. 3. November-December, 1913. Fort Monroe, Va.: The Coast Artillery School Press.

"*Boletin* de le Sociedad de Fomento Fabril." Vol. XXX, No. 11. Santiago de Chile: The Society.

"Annual Report of the East Africa Protectorate for the Year 1912-13." By F W. Major. Mombasa: The Customs Department.

"Anleitung zum bau Elektrischer Haustelegraphen-Telephon, Kontroll und Blitzableiter-Anlagen." Edited by Akt.-Ges. Mix and Genest. 1914. Berlin: A. Seydel.

"Soft Soldering, Hard Soldering and Brazing." By James F. Hobart. Price 4s. net. "Transmission Line Formulas for Electrical Engineers and Engineering Students." By H. B. Dwight. Price 8s. 6d. net. 1913. London: Constable & Co.

"Fowler's Mechanical Engineer's Pocket-Book, 1914." Price 1s. 6d. net. "Fowler's Mechanics' and Machinists' Pocket-Book and Diary, 1914." Price 6d. net. Manchester: Scientific Publishing Co.

"Celluloid Dangers—with some Suggestions." By D. W. Wood. 1913. London: British Fire Prevention Committee. Price 2s. 6d.

"Electrical Engineers' Diary, 1914." London: S. Davis & Co. Price 3s. 6d.

"Examinations in Science and Technology, 1913." London: Wyman & Sons, Ltd. Price 9d.

"*Transactions* of the Illuminating Engineering Society." Vol. VIII, No. 8. November, 1913. New York: The Society. Price 75 cents.

"*Memoirs* of the College of Science and Engineering, Kyoto Imperial University." Vol. 5, No. 8. October, 1913. Kyoto, Japan: The College.

"*Boletin* de Ingenieros." Vol. IV, No. 3. November 16th, 1913. Mexico: Secretaria de Guerra y Marina.

Calendars and Diaries.—THE ARMORDUCT MANUFACTURING CO., LTD., of Farringdon Avenue, London, E.C., have issued to users of their perpetual desk calendar a set of refill engagement slips for 1914, to take the place of the record of 1913 just removed.

From MR. JOHN WHITELAW, 15A, Duncan Street, Edinburgh, we have received a wall calendar with monthly sheets for the year, each sheet having a half-tone picture of general interest.

MESSRS. VENNER & CO., of 6, Old Queen Street, Westminster, have sent to all their usual friends, as a New Year souvenir, a handy little toothpick. Their stock has been practically exhausted, but any of the aforesaid friends who appear to have been overlooked, are asked to communicate with the firm.

From the SUN ELECTRICAL CO., LTD., of 118 and 120, Charing Cross Road, London, W.C., we have received a specimen of the penknives that they are distributing to customers and friends. Should any of these have gone astray in the post, a word to the firm will bring a second along. If any recipients prefer not to accept a knife as a gift and would like to send a small coin to the firm, money so received will be credited to the Electrical Trades Benevolent Institution. Now we shall all have pensions!

The *Chemical Trade Journal*, in accordance with its custom, has issued a wall calendar for 1914, with monthly sheets.

To MESSRS. SWITCHGEAR & COWANS, LTD, Springfield Lane, Salford, Manchester, we are indebted for a capital breastpocket diary and notebook (Letts's) for 1914, with insurance coupon. The opening pages contain neatly arranged illustrated matter and prices relating to some of their standard electrical items in common use, including circuit breakers, oil switches, and mining switchgear. A limited number of copies are still available for "suitable applicants."

From POPE'S ELECTRIC LAMP CO., LTD., of Hythe Road, Willesden, we have received a wall calendar for the New Year with tear-off daily slips.

From MESSRS. STEWARTS & LLOYDS, LTD., we have received one of their excellent desk calendars for 1914 with monthly cards. The framework is, as before, in white and gold.

From the ELECTRIC CONSTRUCTION CO., LTD., we have received a very acceptable vest pocket card and stamp case containing calendar and engagement diary for 1914 (a Letts's "Peerless"), with accident insurance coupon.

THE DIAMOND COAL CUTTER CO., of Wakefield, has issued a wall calendar for the year with monthly slips.

The excellent poster recently issued showing in a homely fashion how a Bastian electric radiator makes you as warm as toast, has been issued from 185, Wardour Street, W., with MR. BASTIAN'S compliments, in the form of a calendar with monthly tear-off slips for 1914.

MESSRS. HAYWARD TYLER & CO., LTD., of 99, Queen Victoria Street, E.C., have circulated among their friends a pocket diary with 1914 and 1915 calendars. As usual a number of pages are devoted to useful memoranda on water pumping and other such matters.

We have again been favoured with one of the very presentable pocket diaries of the DUSSEK BITUMEN CO., of Canal Bank, Deptford, S.E. It has ample daily spaces, card stamp and other pockets, also an insurance coupon.

MESSRS. ALFRED GRAHAM & CO., of St. Andrew's Works, Crofton Park, S.E., have issued one of their handy pocket volumes containing speed and tide tables for the principal seaports of the United Kingdom for 1914. Other information given relates to port charges, knot tables, distance tables, electrical terms, &c. A 1914 calendar appears at the beginning, and some pages for memoranda at the end, of the book.

MESSRS. NALDER BROS. & THOMPSON, LTD., of 97A, Dalston Lane, London, N.E., have issued a calendar in their now quite familiar style and size with monthly slips for 1914. A list of agents keeping stocks of the N.C.S. manufactures appears at foot of each sheet.

THE ELECTRIC SUPPLY PUBLICITY COMMITTEE, of 20A, Tudor Street, London, E.C., has issued a calendar for 1914 for circulation by supply companies and local authorities. Four circular views in colour show electricity in service in the home. Personally, we prefer not to be in an overwhelming blaze of light when we want to get to sleep. The monthly date slips each have a different illustration showing domestic electrical applications.

MESSRS. THERMIT, LTD., of 27, Martin's Lane, Cannon Street, E.C., again send one of their pocket note-books. It is not a diary, but contains 1914 and 1915 calendars. As usual the opening pages are full of information, appropriately illustrated, concerning the Thermit system of welding.

LIGHTING and POWER NOTES.

Alton.—PROV. ORDER.—The U.D.C. has decided to make inquiries as to the cost of obtaining a prov. order for electricity supply.

Ardee (Co. Louth).—An E.L. scheme for this town is to embrace about 30 lamps of 50 C.P. each, at an annual cost of 30s. per lamp.

Atherton.—The U.D.C. is proposing to adopt a revised scale of charges for power and heating, ranging from 1½d. to ⅝d. per unit, the latter for over 12,500 units per quarter.

Aylesbury.—The U.D.C. has decided to purchase a site on the Canal Wharf for £754 for the proposed electricity works.

Basingstoke.—L.G.B. INQUIRY.—Mr. T. C. Ekin, on December 18th, held an unopposed inquiry into the application of the T.C. to borrow £14,000 for the purposes of an electricity undertaking. There was a balance of £1,605 on the sum asked for, which would be apportioned as to £600 for meters and services, and £455 for mains extensions. The L. & S.W. Railway Co. has provisionally agreed to take 50,000 units per annum at 2d. per unit, and would probably require 80,000. The charge to small consumers would be 6d. per unit.

Bexley.—STREET LIGHTING.—A scheme, prepared by the Electricity Committee, for improving the public lighting has been approved by the U.D.C. The scheme provides for 100 lamps in four roads and 80 lamps in eight roads. All lamps at the junctions of streets (except where 100-C.P. lamps are used) are to be of 80 C.P., and the remainder of 40 C.P. The Committee is prepared to give the improved lighting at the same cost as at present, viz., £1,235.

Blackrock.—PROV. ORDER.—The U.D.C. prov. order for electric light has been extended for one year.

Bradford-on-Avon.—The U.D.C. and the R.D.C. have been asked to consent to the application of Mr. J. H. Edwards for a prov. order for E.L. The U.D.C. has arranged to consider the matter early in January, and the R.D.C. has deferred discussion pending the receipt of further information.

Brighton.—ELECTRIC COOKING.—The T.C. has decided to supply electricity to the Royal Sussex County Hospital on special terms, whereby the demand will be more than doubled, and 20,000 or 30,000 additional units will be used for cooking, the account being increased from £100 to £250 per annum.

Bromley (Kent).—A new tariff for electricity, under which consumers will be supplied on a fixed quarterly charge, based on the adequate lighting of the whole of the premises, plus 1½d. per unit, for lighting, heating or cooking, has been brought into operation by the E.L. and Power Co.

Brough (Penrith).—E.L. SCHEME.—At a meeting held last week it was decided to form a company for the purpose of installing electric light in the village.

Canada.—By-laws have been passed as follows:—Medicine Hat, to expend $150,000 on plant extensions at the electricity works; and Beausejour, Man., to install an electric light system, at a cost of $3,000.—*Canadian Electrical News.*

The South Vancouver (B.C.) ratepayers are supporting a proposal to construct a municipal power plant on the Fraser River, at a cost of $300,000.

Chiswick.—E.L. PURCHASE SCHEME.—The future of the electricity undertaking, when it is purchased, came up for discussion by the District Council last week, and it was decided that for five years the Council shall work the undertaking itself, despite counter proposals that the Council should be left free to consider the matter when the purchase price is settled.

Coggeshall (Essex).—E.L. SCHEME.—Steps are being taken by private persons to provide a supply of electricity for the parish.

Continental Notes. — NORWAY. — The Norwegian Hydro-Electrical Nitrate Co. has recently placed an order with the Thune Works for 18 large Babcock & Wilcox boilers, which are to be installed in the company's new factories at Rjukan II. The heat will be derived from the electrical furnace gases, and the total capacity of the boilers will be 35,000 H.P. The same works have obtained an order from the Cristiania Council for seven boilers, which are to be installed at the municipal electrical works.

SWEDEN.—It is reported from Stockholm that a new company has recently been formed for the purpose of acquiring and developing waterfalls and selling the electrical energy obtained from them. The capital has been fixed at a minimum amount of £833,300, and the shares are to be offered to the public at 110 per cent. The new company will thus, from the start, have a reserve fund of £83,300 at its disposal. Two electrical power stations, viz., at Ramnes and at Seglingberg, have already been acquired by the company, and will be paid for in shares.

GERMANY.—According to Engineer Baumann in the *Electrotechnische Nachrichten*, the future of Berlin's electricity supply is rather a complicated problem. The municipal contract with the Berlin Electricity Works expires on October 1st, 1915, and, should the city take over the company, municipal management, according to this writer, will certainly involve higher administrative costs, and less freedom in technically developing the undertaking. The writer considers that either a bulk supply purchased from the company, for the centre of the city, or a scheme of joint control, would be the best solution of the problem.

AUSTRIA.—The report of the Vienna municipal electricity department for the year 1912, shows that at the end of that year there were working 18 steam engine sets of 36,800 H.P., and 12 turbine sets with a total of 101,500 H.P. The cable network has risen to 45·63 km., and the connected installations for light and power supply to 9,235. The total invested capital amounts to 114·14 million kronen. The receipts were 32·395 million kronen, and there was a gross excess of 17·39 million kronen. Coal deposits at Zillingdorf are to be used to generate electricity when the station at Ebenfurth is completed, the current being transmitted to Vienna, to displace in part the electricity generated there from imported coal.

RUSSIA.—Plant is being established at the works of the Société Metallurgique du Sud-Ural, to utilise the water power of Lake Oust-Kataw in the generation of electrical energy for power purposes.

Connah's Quay.—ELECTRIC LIGHTHOUSES.—On Tuesday, last week, the new electric lighthouses which have been erected on the lower walls of the Dee for the Dee Conservancy Board were set in operation. The whole of the electrical installation—viz., the cable and lamp fittings—has been carried out by Messrs. Summers and Sons, at a cost of over £1,000, and the cost of the towers, about £225, has been borne by the Board. It is also proposed to install lights on the upper wall of the river, and in addition to these, floating lights are to be laid in the river channels below the town of Flint, the current being supplied from the works of the firm mentioned.

Croydon.—The T.C. has decided to extend the mains to the Woodside district, at an estimated cost of £798, and will probably supply a factory *en route* with current.

Dublin.—STREET LIGHTING.—The Electricity Supply Committee has issued a report stating its intention to gradually replace the present arc lamps, which are becoming inefficient, with the best type of flame arc lamps. A number of tenders had been received, but the firms whose lamps were up to the standard required, were not at first disposed to give a free trial of a full circuit of 22 lamps, without which the city electrical engineer did not consider that a proper trial could be made. The General Electric Co. and Messrs. Johnson & Phillips agreed to the terms, and the trials proved so satisfactory that the Committee recommended the taking over of the lamps. Trials were also made of a new type of contact gear, and in this case Messrs. Crompton and Co.'s was found most efficient.

Easingwold.—E.L. SCHEME.—Mr. Chas. E. Best, the representative of the company promoting the proposed E.L. scheme, has informed the R.D.C. that it is proposed to supply current at 6d. per unit, and that a capital of £2,000 will be needed. It is understood that the Council will raise no objection.

Harwich.—PROV. ORDER.—A special meeting of the T.C. recently agreed to the action of the General Purposes Committee in giving notice of its intention to apply for a prov. order for electric light. A report on the matter prepared by Mr. Haydn Harrison was also approved.

Masham.—The U.D.C. has approved a draft agreement with the company promoting an E.L. scheme for the district.

Haslingden. — PUBLIC LIGHTING. — The electrical engineer has been instructed to prepare an estimate for fixing electric lights on all the tramway standards from Hudrake to Lockgate, and altering the system from three lights to two lights. The Electricity Committee has approved a scheme for lighting the main road from Hudrake to the borough boundary at Baxenden.

The B. of T. has sanctioned the purchase of machinery in connection with the sub-station at a cost not exceeding £700.

Heston-Hounslow.—E.L. COSTS.—In a recent debate on the subject of electricity *v.* gas, Mr. P. E. Rycroft, referring to the cost of electric lighting, mentioned that for 40 houses in one road the average cost last year was £3 6s. 4d. per house; 16 large houses paid £7 4s. 6d. each, and 21 houses in another road averaged £2 4s. each. Mr. Rycroft submitted that the average householder would prefer to pay this figure for electricity than to have gas supplied free.

Holmer.—The Hereford T.C. has informed the R.D.C. of its intention to apply to the B. of T. for an order to supply electricity at Holmer, and to dispense with the consent of the R.D.C. A conference between the Councils is to be held with a view to an amicable settlement.

Hoylandswaine.—PROPOSED E.L.—The U.D.C. has resolved to ask the Yorkshire Electric Power Co. for its terms for the electrical lighting of the streets and cottage houses.

Ilford.—L.G.B. INQUIRY.—A recent application by the U.D.C. for a loan of £21,578 for extensions at the electricity works and the provision of a refuse destructor met with opposition from the Seven Kings Ward ratepayers.

Kingston-on-Thames.—The T.C. has accepted an offer of £750 from the M.A.N. Co. as compensation for the delay in the delivery of the two Diesel engines.

Kirkby Stephen.—E.L. SCHEME.—Mr. C. H. Best, of Bradford, has given notice to the East Ward R.D.C. that a company is being formed for the purpose of supplying electricity to Kirkby Stephen and the immediate neighbourhood. It is the intention of the promoters to apply for a prov. order forthwith.

Manchester.—TRAFFORD PARK POWER PURCHASE.—The Corporation Parliamentary Bill discloses that £200,000 will be the sum paid for the works and property of the Trafford Park Power and Light Co. There is considerable expenditure for the electricity undertaking proposed in addition to this sum, but no actual figure is given.

Northampton.—The E.L. and Power Co. has reduced the price of electricity for lighting and cooking from 1½d. to 1d. per unit.

Peterborough.—The Corporation having received an application from Messrs. Farrow & Co. for a supply of power to their factory at Fletton, has decided to offer a minimum of 75,000 units per year for five years, at 0·9d. per unit. The cost of the main to the factory is estimated at £1,888.

Reigate.—PROV. ORDER.—Mr. Gilbert Allom intends applying for a prov. order for E.L. for the parishes of Banstead, Walton-on-the-Hill, and Kingswood. The Kingswood Ratepayers' Association has suggested that power should be obtained in the order to secure current for public lighting at half the maximum rate.

South Africa.—The Ladysmith (Cape Province) municipality proposes to borrow £7,000 for an electric lighting scheme.

The Cape Town Corporation proposes to call a ratepayers' meeting to sanction a loan of £100,000 for electric lighting purposes. Of this amount, £67,707 has already been authorised by the Council. The expenditure of the following sums will have to be specially authorised :—

Cape Town.—Extension of mains, services and meters, £11,500; coal-handling plant, £1,500; supply to proposed blanket factory, £700; contingencies, £5,000.

Kalk Bay.—Changing voltage, £1,150; extension of mains and private connections, £1,500; estimated cost of connecting Cape Town with Wynberg and Kalk Bay, £9,182.

Four additional sets of steam turbines and generators, of a total of 48,000 KW. capacity, and three 7,500-H.P. steam turbine-compressor sets, have been lately ordered from the A.E.G., of Berlin, by the Victoria Falls and Transvaal Power Co.

According to the *African World*, a proposal is on foot to construct a large electrochemical works at Tweefontein, adjacent to the colliery of that name. Plans prepared by Messrs Harpur Bros. and Co. indicate a Mond producer plant to deal with 400,000 tons of coal a year, boilers fired with producer gas, and a steam turbine plant of 15,000 KW. The chemical plant will produce 22,000 tons of sulphate of ammonia and 10,000 tons of tar and distillates a year. Tests with this coal in similar producers show a yield of 119 lb. of sulphate of ammonia per ton under ordinary working conditions. The power plant will be coupled by means of a 50-mile, 80,000-volt transmission with the Rand power supply.

Rathmines (Dublin).—L.G.B. INQUIRY.—Mr. P. C. Cowan held an inquiry last week into an application by the U.D.C. for sanction to a loan of £12,160 for the purpose of extending the electricity works and purchasing a free wiring installation. There was no opposition.

St. Albans.—WORKHOUSE LIGHTING.—The B. of G. has decided in favour of electric lighting in the workhouse.

Stratford-on-Avon.—PLANT EXTENSIONS.—The E.L. Co. has installed a new 150-H.P. Hornsby engine and 80-KW. Newton dynamo. A cooling tower has also been erected, the work being carried out to the specifications of Mr. C. D. Falcke, London, and under the superintendence of the resident engineer.

Torres.—E.L. PROPOSALS.—In their report to the T.C. on the proposed E.L. scheme, Messrs. J. & W. Purves suggest that 84 50-C.P. street lamps should be installed—72 estimated to cost 30s. per lamp per annum, and 12 all-night lamps costing 50s. per annum each ; 6d. per unit would be charged to private consumers for lighting, and 3d. per unit for power and heating. The annual expenditure is estimated at £789.

Weaverham.—VILLAGE SUPPLY.—The villages of Sandiway, Cuddington, Oakmere and Gorstage have now secured a supply of electricity, the extended supply of the Weaverham Electric Supply Co. being officially started last week by Dr. Smith, chairman of the company. The directors and officials afterwards took dinner together upon the invitation of Messrs. Johnson and Phillips, Ltd., who carried out the contract, The Weaverham Electric Supply Co. was formed in 1910, and started supplying electricity in the following year to 20 consumers with an aggregate of 1,000 lamps. At the end of 1912 there were 65 consumers, and 5,000 lamps were in use in Weaverham ; whilst there are now 6,500 lamps in use. In the district for which the new supply caters there are 25 consumers with an aggregate of 2,500 lamps. Current for power purposes is supplied at 1d. per unit, and for lighting at 6d. per unit. The cottager is allowed the use of one light per week for 3d., and there is no restriction on the use of his light. The transmission from Weaverham to Sandiway and other villages is by 3,000-volt underground duplicate cables, the supply being transformed down to 220 volts for local use. Mr. A. J. Leigh was the consulting engineer for the scheme.

West Yorkshire.—E.L. POWERS.—The Yorkshire Electric Power Co. has asked the Stanley, Methley and Birkenshaw U.D.C.'s, the Tadcaster and Barnsley R.D.C.'s, and the Hemsworth P.C. to support its application for powers to supply electricity for lighting.

TRAMWAY and RAILWAY NOTES.

Aberdeen.—SUBURBAN CAR SERVICE.—The suburban Tramways Co. has asked the Corporation to amend the agreement between the company and the Corporation, especially with reference to the payment by the Corporation of 3½d. per car-mile for traffic expenses and rolling stock charges, which the company thought should be increased. A sub-Committee was appointed to consider the matter. A sub-Committee is also considering a proposal to purchase the Militia Barracks for car-sheds and tramway purposes. It is estimated that the alterations would cost £9,192.

Continental.—ITALY.—Figures recently published show how much the introduction of electric tramways into some of the principal Italian cities is due to foreign capital and enterprise. The electric tramways of Milan have an extent of 131 km., 126 of which form the network installed and worked by the Italian Edison Co. The Naples system of tramways, 142 km. in extent, is owned by the Società Anonima dei Tramways Napoletani, whose headquarters are at Brussels. The tramways at Brescia of the Società Ellettrica Bresciana, 55 km. in extent, the 29-km. urban network at Turin of the Società Torinese di Tramways e Ferrovie Economiche, and the 18-km. system of the Unione Italiana Tramways Elettrici at Genoa, are apparently of Italian ownership ; but the 83-km system at Florence of Les Tramways Florentins is a Belgian undertaking So also is the 106 km network of the city of Vercelli, but the motive power in this case is steam. Altogether, 351 km. out of a total of 453 are the outcome of foreign electrical enterprise and capital.

According to the *Standard*, the Direction of the State Railways is now electrifying the tunnels north of Genoa, and the stations of Genoa and S. Pierdarena At the same time operations are being carried on for the double tracking of the line between Genoa and Spezia.

Darwen.—The manager has presented a report to the Tramways Committee relative to the three months' working of cheaper fares, and it has been decided to adhere permanently to the fares. An increase of 26·75 per cent. in the receipts between the hours of 12 noon and 2 p.m. has been recorded as a result of the dinner-hour tickets. Deducting the general increase of 8·7 per cent. over the whole system during the previous six months, the increase is 18·05 per cent. Extra cars have been required to deal with the increased traffic, but after allowing for this the extra cars return a profit of 5·15d. per car-mile. The all-round net increase in favour of the new cheap return tickets and dinner-hour tickets is 13 per cent.

Huddersfield.—The borough engineer has been instructed to report upon doubling the track on the Outlane, Longwood, and Sheepbridge tramway sections.

London.—It is reported that trials are being made by the Aerated Bread Co., Ltd., with an electric motor van for the delivery of goods to the various depôts.

The new Bill, which the G.N. and Metropolitan Railways are introducing, seeks to hand over to a joint Committee of the two companies, the G.N. and City line recently acquired by the Metropolitan Co. It would also empower the G.N. Co. and the joint Committee to construct new railways. It is proposed to connect the line to the Metropolitan Railway and a direct connection with the Waterloo and City line is contemplated.

According to the *Daily Telegraph*, the L.C.C. trailer-tramcars have been so successful on certain Southern routes that, pending the sanction of the B. of T., the Council is obtaining prices for 150 trailer cars and about 200 couplers. The new cars are to be of a different pattern to those in use at present.

Oxford.—The Watch Committee has decided to recommend that five licences each should be granted to Mr. Morris, Mr. Cownie (National Electric Construction Co.), and Messrs. Tilling, for motor-'buses ; meanwhile, Mr. Morris has commenced a service of 11 'buses (unlicensed) to various parts of the city. A meeting of the Tramways Co. has also been held, when an official statement of this company's position in regard to the recent developments was made.

Nelson.—RAILLESS TRACTION SCHEME.—The Tramways Committee is considering a scheme of railless traction for Walverden and Southfield districts. An extension of the present system is regarded as impracticable owing to the expense of widening streets. After considering the claims of motor-'buses and railless traction, the Committee strongly favours the latter. A scheme will come before the Council at an early date.

Walthamstow.—The G.E. Railway Co. has written stating that it is unable to agree to the Council's proposal to run tramways into the Hoe Street Station yard, and suggesting that the tramway should run down Selborne Road. The company is to be informed that while the Council's proposal, as originally made, could probably be carried out for the cost of the work alone, the alternative proposal would entail the cost of a prov. order, which would make the cost prohibitive.

TELEGRAPH and TELEPHONE NOTES.

Anglo-Swiss Telephony.—The Post Office announced this week that on and after January 1st, 1914, telephonic communication with Basle, Geneva and Lausanne would be obtainable from all subscribers' telephones and call offices within the Inner London telephone area which are available for inland trunk service. The charge for a call of three minutes' duration will be 7s. 6d. during the hours of day service, and 4s. 6d. during the hours of night service.

Egypt.—It is stated that the telephones of Egypt are about to be taken over by the Government and nationalised, the purchase price mentioned being £E.1,300,000. The capital of the Telephone Co. of Egypt in 1911 was £E.400,000. The number of shares now in circulation is 36,000 of a face value of £E.5 each, while there are 4,000 founders' shares. The reserve fund of the company amounts to £E.88,728. In all there are 47,346 km. of telephone wire in Egypt, the property of the company. For the year 1912 the revenue of the company was £E.145,348, and the expenditure £E.81,294, leaving a profit of £E.64,054, from which a dividend of 12 per cent. was paid.—*I. and E. Engineer.*

Germany.—The German Reichspostamt has decided that wireless communication between Germany and her African Colonies shall be opened on May 15th next. To this end work is being prosecuted at the head station at Nauen day and night. To guard against eventualities, besides the five towers 120 m. high, a giant tower of a height of 250 m. is being built, at the rate of 20 m. a week A large Arco high frequency machine will also be employed, whose high-frequency capacity of over 150 KW. is said to exceed that of any high-frequency machine hitherto built.

Lancashire and Cheshire.—Important developments in connection with the telephone and telegraph services are pending in various parts of South Lancashire and North-East Cheshire. Since April 1st last, 57 miles of new underground pipes have been authorised for local exchange services, of which 26 miles have already been laid.

New Telephone Cable.—The laying of the new cable between Nevin, in Carnarvonshire, and Howth, near Dublin, was completed this week by the P.O. cable ship *Monarch* in heavy weather. The cable is nearly 74 miles long, and contains four cores, with Pupin loading ; it was made by Messrs. Siemens Bros. and Co., and is the longest submarine telephone cable yet laid.

New Wireless Stations.—The new wireless station at Cape Finisterre, constructed by the Compania Nacional de Telegrafia sin hilos, has been opened for public service. It has a range of 400 km. A station at Cape Palos, with a range of 200 km., has also been inaugurated. Progress is being made with the erection of the station at Almellones, near Malaga.—*Electron.*

(*Continued on page* 23.)

THE RJUKAN NITRATE WORKS AND ELECTRICAL PLANT.

I.—THE POWER PLANT.

[BY OUR SPECIAL CORRESPONDENT.]

AMONG the best known Norwegian waterfalls is the Rjukan—the highest one in the country—which owes much of its fame to the wild and lovely scenery which surrounds it on all sides.

THE RJUKAN WATERFALLS.

During the last few years great changes have taken place near Rjukan, and much of its one-time natural beauty, the delight of the sightseer, has disappeared to give place to the utilitarian development which is such a feature of modern Norwegian life.

Thus, as our views show, this wild mountain valley of a few years ago, now contains a town of 5,000 to 6,000 inhabitants, which has sprung into existence as a direct result of the water-power development at Rjukan.

This, moreover, has resulted in the annual production of 100,000 tons of fertilising nitrates, a material which is almost indispensable to the agriculturist. Our first view shows the Rjukan before it was harnessed, while the lower views on page 20 show Saaheim in 1907, and part of the same place in 1912 with the Rjukan I factories on the left.

The Rjukan waterfall, from which energy is derived for the nitrate works, is situated on the Maane River, and has a natural head of 260 m., which has been artificially increased to 570 m.

The whole scheme for the harnessing of the fall has been divided into two stages, Rjukan I and II, of which the first was completed in 1911, and the second will be completed in 1915. The total amount of power has been estimated at nearly 270,000 electrical H.P., of which 145,000 H.P. will be developed at Rjukan I, and about 125,000 H.P. at Rjukan II.

General Description.—The regular supply of water to the two power stations is secured by a lake, the Mösvandsdam, which is situated about 900 m. above the sea, and is capable of holding 850 million cb. m. of water. It is the largest artificial lake in the world for the storage of water for industrial purposes. From the Mösvandsdam the water is conducted 4 km. through a tunnel with a transverse section of 26 sq. m. to a collecting basin, and then falls through ten flumes to the Vemork power station, 300 m. below. The diameter of each flume is 1·5 m. at the upper end, gradually decreasing to 1·25 m. at the lower end. The upper sections are of riveted steel-plate, while the lower ones, where the pressure reaches 30 atmospheres, are made from 1-in. welded plate; the flumes rest on a foundation built upon the solid granite of the mountain. The total quantity of water passing through these flumes is 50 cb. m. per second.

From the Vemork power station electrical energy is transmitted over high-tension cables to the nitrate works at Saaheim, which are situated about 5 km. below in the valley.

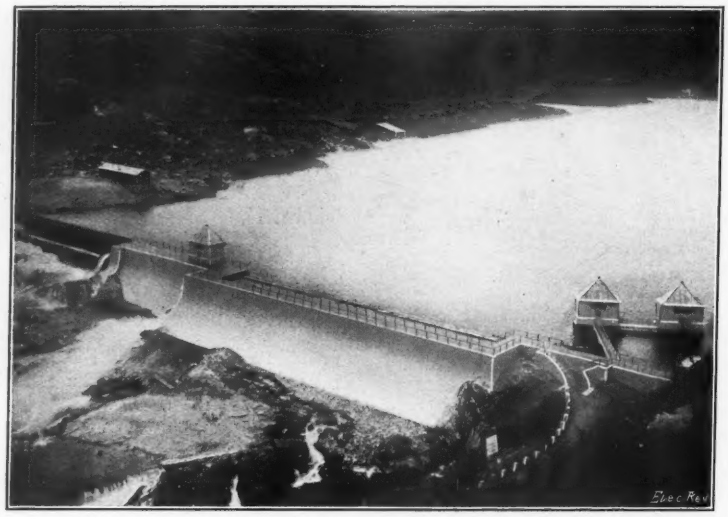
The Turbines.—In the Vemork power station are installed 10 turbines, each of 15,700 H.P., and efficiency 80 per cent.; the latter would be somewhat higher at a normal load of about

THE VEMORK POWER STATION, PIPE LINE, AND FALL.

14,300 H.P. Nine turbines meet normal load conditions, one being kept in reserve in case of accidents. The turbines are double Pelton wheels with two nozzles per wheel, and the speed regulation is by pressure oil motors and automatic pressure regulators, which act when the pressure of water in the flumes exceeds a certain limit. Apart from the above, there is also installed a 1,000-H.P. unit, which serves as a reserve exciter and supplies the lighting.

The Generators.—These are coupled direct to the turbines; each has a capacity of 17,000 K.V.A., ·6 power factor, and generates energy at 10,000-11,000 volts pressure and 50 cycles, the speed being 250 R.P.M.

When these machines were ordered, the arrangement for the coupling of the electrochemical furnaces in the factories had not been decided, and nine of the generators were therefore ordered as double units, each half with a capacity of 8,500 K.V.A., but so constructed that they could work either together or separately. The machines are of the two-bearing type, as is the case with the tenth generator, which is a single machine. It was specified that the weight of any single piece should not exceed 15 tons, also that the largest diameter for transport should not exceed 4 m. Each generator is provided with a direct-coupled exciter, for greater security of working. The arrangement has disadvantages, but the power and space required are somewhat less than when separate exciters are employed.



THE MÖSVANDSDAM, SHOWING HEADWORKS, &C.

The generators are provided with a special ventilation system, with ducts for the incoming and outgoing air and 280 cb. m. of air per second are required. This arrangement was adopted, as otherwise it would have been necessary to renew the air in the engine room every three minutes to make it possible for the attendants to stay there during the cold season.

A large ventilating tunnel has, therefore, been provided in the foundations, from end to end of the engine room, with branches of smaller dimensions leading to the divided generators, in which are placed adjustable valves for reducing the air pressure. These valves are regulated from switch pillars, which also serve as instrument pillars for the generators. The air after passing through the generator windings is conducted to vertical channels discharging into the atmosphere. The various air channels are interconnected to make it possible to conduct the hot air back to the incoming ducts during the winter, when it is necessary to preheat the air somewhat, to melt snow and ice in order to prevent it from accumulating and obstructing the channels.

The generators have been supplied partly by the Allmänna Svenska Elektriska Aktiebolaget, in Sweden, and partly by the Brown, Boveri Co.

In the case of the Swedish generators, constructed as double units with very little space between, the stators, each built in four parts, are arranged to move sideways on the bed.

The stator core plates are ·35 mm. thick, arranged in 16 different groups with intermediate air spaces 10 mm. wide between each group, and open slots for the windings. The internal core diameter is 4,150 mm., and the external diameter 4,800 mm.

There are three slots per pole per phase, and four conductors per slot. A built-up copper bar conductor is employed, threaded through micanite tube, and filled in solid with wax in order to exclude all air; in the insulation of the end windings mica and wax-impregnated tape are employed. The coils are held in the slots by wedges and the end turns are rigidly supported.

The two halves of the double unit are isolated by means of a fireproof wall between them. The weight of the generator complete is 243 tons, and of the rotor 93 tons.

The latter consists of a steel spider carrying cast-steel magnet rings, with central ventilating spaces and solid pole shoes. The field windings are of rectangular copper strip, and fans and deflectors are provided to ensure the correct distribution of the ventilating air. Both mechanical and gravity lubrication is provided to the bearings, which are water cooled. The exciters are 10-pole machines, designed to meet the conditions resulting from varying speed.

The Brown-Boveri double-generators are of simpler construction. The stator core, which has an internal diameter of 4,400 mm. and external diameter of 5,000 mm.,

1907. 1912.

VIEW OF THE TOWN OF SAAHEIM AND NITROGEN WORKS IN 1912, AND OF THE UNDEVELOPED SITE FIVE YEARS EARLIER.

is constructed with open slots, four per pole per phase, and three conductors per slot.

The rotor, which weighs 90 tons, carries six forged steel magnet rings in two groups with a space between. Cast-steel poles with laminated steel pole shoes are fitted, the windings being of copper strip.

As in the case of the Swedish machines, the exciters are direct-coupled ten-pole generators.

Apart from the double generators, there is a single generator of Brown, Boveri construction, which is, however, built in two parts placed close to each other; this construction was adopted for practical reasons, in view of the great size of an ordinary type of machine.

The switchgear is placed in a separate building, 75 m. long, of reinforced concrete, the switches, bus-bars, &c., being enclosed in fireproof cells. The instrument and control board is on a gallery in the engine room. The chief feature of the switch arrangement is the provision made for each generator to supply over its own transmission line to the particular group of furnaces belonging to it. With this object in view, the 500-ampere leads from each generator are connected direct to the transmission line; it has, however, been found desirable, in order to reduce surges due to the switching in of the furnaces, to connect several machines in parallel, and for this purpose a line-switchboard is provided in shunt with the system of bus-bars. In order to facilitate the switching in or out of the generating sets, the main bus-bars are divided into sections by nine oil switches. The generating sets are coupled through choke coils and water-jet dischargers to the main oil switches and bus-bars, from which the outgoing cables, pass to the transmission lines.

This switchgear occupies three floors in the switch house, the lightning arresters and choke coils in connection with the outgoing lines being installed on the top floor.

The instrument board on the gallery, which is equipped with Siemens & Halske instruments of the Ferraris type, automatic signal lamps, &c., was supplied by the French Westinghouse Co.

Overhead Transmission Lines to Nitrogen Works, Saaheim.

The Transmission.—This is designed to transmit 170,000 K.V.A. over the 5 km. intervening between the power station and factories; 18 cable-systems connect up the nine double generators, and two are provided for the single generator, the transmission being arranged so that the supply voltage in the factories averages 9,500 volts, while the generating station pressure averages 10,500 volts.

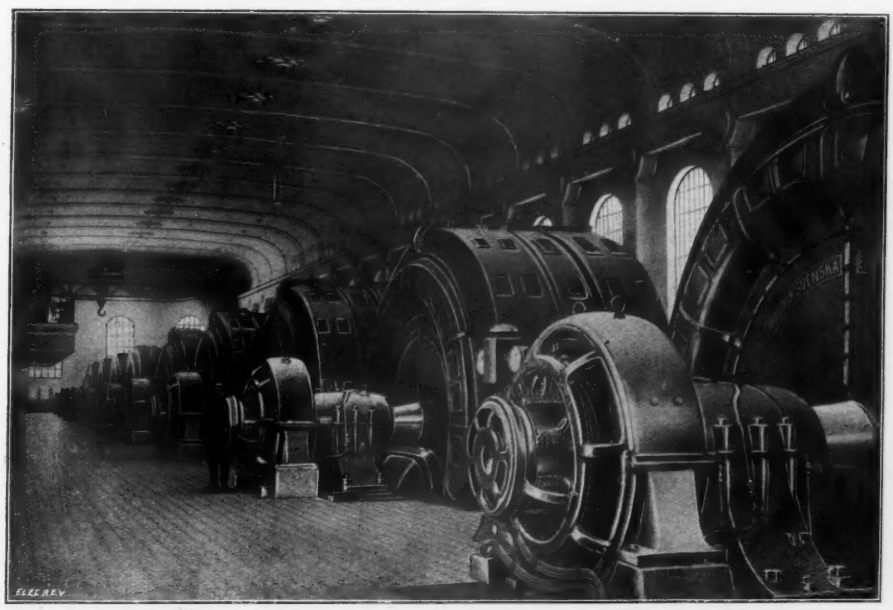
It was, in the first instance, decided to use copper cables, and the order for these was placed, but the price of aluminium falling to £59 per ton, led to a reconsideration of the matter, and, as a result, aluminium cables were adopted instead, with a saving of 30 per cent. when the copper cables were sold; copper was, however, used for a distance of 1,650 m. The copper cables have a sectional area of 150 sq. mm. and each consists of 37 single wires, drawn in a semi-hard condition.

The aluminium cables each consist of 19 wires with a sectional area of 300 sq. mm.

The transmission route was a difficult one, running through a narrow river valley, and it was finally decided to adopt a system comprising 35 groups of masts of five each, the total number of masts being 175. The foundation for the group of five masts has to support about 1,100 tons.

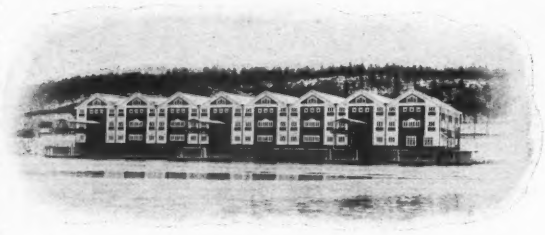
The masts are of steel, each weighing about 2 tons; the cables are spaced 1,200 mm. apart, this distance being fixed to allow a safe margin when the cables swing in stormy weather.

The distance between the groups of masts varies considerably on account of the uneven ground; the average distance is about 100 m., but in some places spans are used up to 250 m. The masts are fitted with pro-



Interior of the Vemork Power House, showing Hydro-Electric Units.

tecting-nets in order to allow of repairs being carried out on one line while the next is alive. The insulators were tested to 70,000 volts. The whole transmission line was completed in 1911 and tested soon afterwards at 30,000 volts. Since that time the transmission plant has been constantly at work, and has given great satisfaction. As an



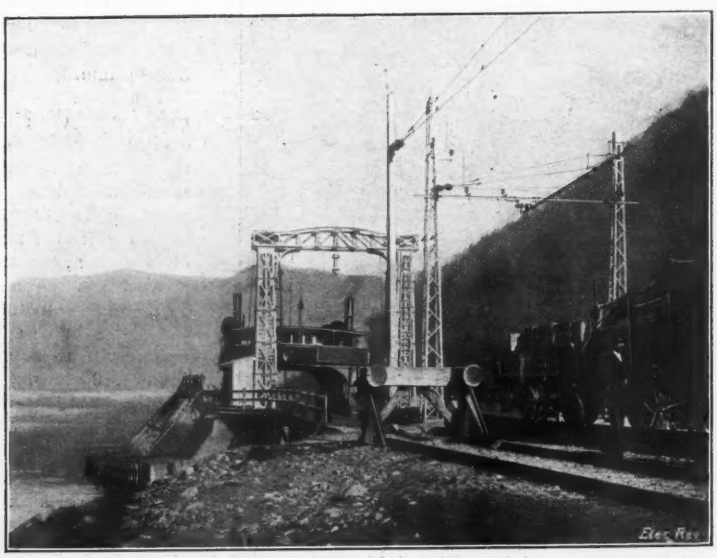
Storage Buildings for Nitrate Products.

instance of what strain such a plant can be subjected to, it may be mentioned that the cables not in use have frequently been covered with a layer of snow up to 8 cm. thick, and the natural thickness of a cable has even been increased to 25-35 cm. by the snow. When in use the cables are only covered with some rime frost.

Transport from Rjukan I.—Between the Vemork power station and the nitrate factories at Saaheim a railway has been built along the mountain side, some 5 km. long, and is worked by steam.

The products from the factories are forwarded by rail to the Tinsjö Lake, which is situated about 10 miles from Saaheim; this railway is worked electrically.* On arrival at Tinsjö, trains of up to 14 wagons are embarked on ferry steamers, in order to avoid transhipment, and after a two hours' journey across the lake to Tinoset, are transferred to another electric railway running to Notodden, a distance of about 19 miles. Here the goods are transferred to large barges for a four-hour journey across the lake of Nordjö, at the lower end of which three locks connect with the sea at the town of Skien, where the company has erected some huge buildings for the storage of the products until they are shipped.

Rjukan II.—As previously mentioned, the Vemork power station for Rjukan I is situated 300 m. above the Lake of Tinsjö, and it is now intended to employ the same water for another power scheme, Rjukan II, for which purpose the water will pass through a tunnel, 32 sq. m. in area to Saaheim. Work on this is now proceeding, and a number of adits have been driven into the mountain, some of them



Electric Railway and Lake Transport between Saaheim and Sea.

to a depth of 90 m., in order to reach the line of the tunnel. Above Saaheim a distributing basin of 1,000 sq. m. area is now under construction, to receive the water from the tunnel, and directly underneath this dam is the site for the Rjukan II power station. The fall will be about 280 m., and it is estimated that the power developed will amount to about 125,000 h.p. From both stations the production will thus amount to nearly 270,000 h.p.

In conclusion, it may be mentioned that the company also has the Tyin and the Matre Waterfalls, with a total capacity of 160,000 h.p., and another project is under consideration in Norway for the harnessing of some 250,000 h.p. But Rjukan I and II combined will scarcely be surpassed by any other power scheme in Norway and, so far, the Vemork power station is the largest electrical plant in the world under one roof.

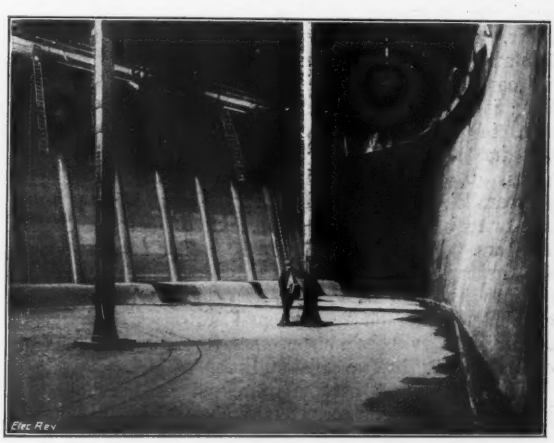
* See Elec. Rev., February 28th, 1913.

NOTES FROM CANADA.

[From our special correspondent.]

The correspondence which has recently appeared in the columns of the Review on the subject of Canadian electrical trade is very interesting on this side.

Discussion of Canadian electrical matters in your paper has, during the last two years, largely centred on the



Distributing Basin, Rjukan II Power Scheme.

"National Electrical Code," and the Underwriters' Laboratories in Chicago. To some extent this is perhaps natural, but it must be remembered that there are many electrical things with which the Underwriters' rules are not concerned excepting in regard to installation.

The "National Electrical Code" is silent as to the types or methods of manufacture of generators, motors, transformers, meters, and all kinds of instruments, so that manufacturers of these and the question of Canadian trade in them are practically unaffected by the Underwriters. It may be said that these rules deal with *installation* of *all* electrical machinery, apparatus, &c., and with the *design* and *manufacture* of only such materials or articles as are used for the transmission, distribution, control and utilisation of electric energy but not of those which are employed in its generation, transformation or measurement.

It is freely admitted that the N.E.C. is far from perfect, and as has been already stated in these notes, the Underwriters themselves acknowledge their inability to do more than *suggest* such rules as have special reference to the life hazard.

Mr. Andrews's remark as to there being "a number of . . . very necessary rules and regulations *for the protection of life* in Canada" (the italics are those of the present

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writer) is hardly correct as it stands ; the rules are made primarily to take care of the fire risk, and the great majority of them have been drafted *after* a fire has occurred from some particular cause, in order to guard against a similar happening in the future—incidentally, many of the rules cover the life hazard also, but they can hardly be said to be rules *for the protection of life*.

Undoubtedly one of the chief, if not the chief, defects of the N.E.C. is that the body responsible for it is not in a position rigidly to enforce its requirements in all instances, and it is a matter of common knowledge that a very great deal of work here is never inspected at all, and the Underwriters themselves occasionally "wink at" certain work not strictly up to standard, if the "risk" is worth taking on as an insurance. Again, at least one of their rules is practically a dead letter, as although insulation resistances for installations of various total amperes capacity are given, it is probable that not one installation in 10,000 ever has any sort of an insulation resistance test applied to it. The writer has personal knowledge of one installation where a man has installed his own fittings and made all his joints without any solder—no inspection or test of any kind was made at the time he asked for current, and no questions were asked about the installation. In another installation a man has an "earth" affecting half his lights, and, as a consequence, he gets his current for half the house without its going through the meter ; this has been the state of affairs for about two years, ever since current was first turned on to the house, but no test has ever been made. As it happens, the latter fault chiefly concerns the supply company, which is being defrauded of some of its revenue, but a nasty shock can be obtained from the gas pipe in that house ; and, what is more, there are two gas meters in the cellar, and a distinct spark can be obtained by touching together the pipes leading from these meters. These, of course, are matters which do not affect the manufacturer at home.

In view of Mr. Evershed's recent paper read before the I.E.E. on insulation resistance, it may be interesting to record here that the familiar "Megger" has been put to an unexpected use in this country—apparently with success. The instrument has been used for testing the separate units of suspension type insulation, and is capable of indicating faulty members, the resistance of which, so far as puncture is concerned, is liable to be low, to an extent that is quite surprising. The ordinary electrical engineer would hardly expect that such an instrument would show a reading when applied to an insulation designed to withstand a puncture test of 20,000 volts or more, which may, though faulty, be capable of withstanding, perhaps, half that potential ; such reading may be used as a fairly reliable indication that the insulator will not stand up to the puncture test.

TELEGRAPH and TELEPHONE NOTES.

(*Continued from page* 18.)

New Zealand.—The Governor of New Zealand has made Regulations to come into force on July 1st, 1914, to the effect that any steamship registered in New Zealand and carrying passengers, which is engaged in the foreign or intercolonial trade, and any home-trade steamship authorised to carry not less than 150 passengers at sea, will not be allowed to leave a New Zealand port unless she is equipped with a wireless telegraph installation having a radius of at least 100 miles and carries a skilled operator.—*Board of Trade Journal.*

Pocket Wireless Again.—It is reported in the *Daily Mail* that a pocket wireless telegraph receiver, in the form of a small telephone, which needs no antenna, has been presented to the French Astronomical Society by an engineer, M. Justin Landry. This instrument, which slips with ease into the coat pocket, has only to be brought into contact with any metallic surface, such as an iron railing, a brass curtain rail, or the metal fittings of a motor-car, to enable a listener in Paris to hear the time signals from the Eiffel Tower. Thirty miles from Paris an ordinary spade stuck in the ground forms a receiving station adequate to catch a wireless message, while a telegraph pole with its wires will serve the same purpose to a distance of over 650 miles.

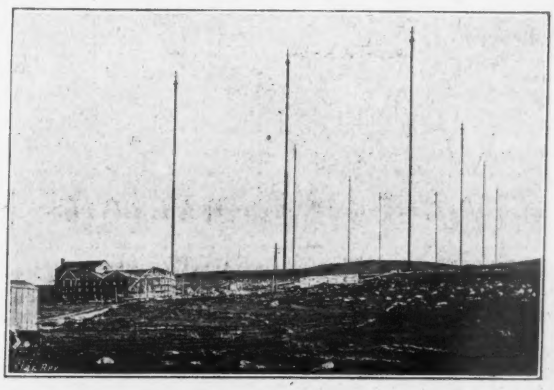
Portsmouth Dockyard.—It is stated that the future semaphore tower, to replace the one that was recently burnt, will be of the Eiffel Tower pattern and fitted with wireless telegraphy.

The Baudot System.—Successful experiments have been made between the London and Birmingham telegraph offices with an elaboration of the Baudot duplex instrument, by which it is possible to make a single wire carry 12 messages simultaneously. Hitherto the limit has been eight simultaneous messages in practical working. The Baudot system is to be adopted between London and Glasgow and Liverpool.

Trunk Telephone Cable.—The Post Office is laying a trunk telephone cable between London and Brighton, a distance of 53 miles. The order for the cable was placed with Messrs. Johnson & Phillips, Ltd., who have begun the work of drawing it in.

Wireless in the Arctic.—The Marconi Co. is engaged on the construction of new wireless telegraph stations in the Arctic Circle at Ketchikan and Juneau. At Ketchikan the plant will be 50 KW. in capacity, and will be capable of working with Seattle, 600 miles to the south, and with Juneau, 200 miles further north. The Juneau station will have a 10-KW. transmitter. These stations form the first links of a chain to provide Alaska with a commercial wireless service connecting it with the United States. As business grows the chain will be developed and provided with auxiliary stations further north.—*Standard.*

Wireless Station at Carnarvon.—The accompanying illustration shows the masts of the new long-distance station which has been erected by the Marconi Co. at Cefndu, near Carnarvon, for trans-Atlantic communication. The station is at an altitude of 800 ft. above sea level, and the last row of masts, according to the *Wireless World*, stands at 1,400 ft. The aerial consists of 32 wires supported on 10 tubular steel masts, each



400 ft. high. For the foundation blocks some 6,000 tons of concrete were used. The earth system consists of two large circles of plates sunk in the ground. There are two generating sets of 500 H.P. for permanent service, as well as various machines for experimental work with continuous waves. All the power used is obtained from the North Wales Power Co.'s station at Llanberis, at 30,000 volts. The station will work direct with New York, in duplex. Copies of the photograph can be obtained from Mr. R. C. Symons, of Llanberis.

Wireless on Board Ship.—Of the 3,500 coast and shipboard stations existing in June last, according to the International Berne List, England owned 138 and 1,062, and Germany 110 and 522, or together 53·9 per cent. of the total. The foundation of the Debeg Drahtlose Telegraphie in 1910 tended greatly to enhance the German figures, the installations of that company on German ships having advanced from 26 in the year named to 355 in the current year. The most important installation made by the company is that on the ss. *Imperator*, which has been designed, profiting from the *Titanic* disaster, to surpass all previous ship installations. A greatly augmented machinery equipment, to minimise the risks of a breakdown, an increased staff (three skilled telegraphiste), with five rooms for their working and accommodation, and threefold antennæ installations, fitted to more than one mast, with an independent minor installation for subsidiary services, are among the features of the improvements ; while the ranges of the sending instruments are (1) 1,500 to 3,000 km., (2) 600 to 1,200 km., and (3) the "Help" call 200 to 400 km.

Wireless in the Antarctic.—A relief ship is now on the way to bring back Dr. Mawson's expedition from the Antarctic regions, and has called at Macquarie Island, where the wireless station which has maintained communication with the expedition is to be placed on a permanent basis, the information obtained from it having proved of great value in forecasting the weather. Dr. Mawson has demonstrated that whenever there is a bright aurora it is impossible to transmit wireless messages. By establishing direct communication with Melbourne, he was able to make magnetic observations at Adelie Land simultaneously with tho made at Melbourne.

CONTRACTS OPEN and CLOSED.

OPEN.

Ainsworth (near Bury).—January 5th. Electric lighting at the Sanatorium, for the Bury and District Joint Hospital Board. Specifications 10s. (returnable). F. Wild, Clerk to the Board, Cross Street, Bury.

Australia.—SYDNEY (NEW SOUTH WALES).—March 18th. For the Postmaster-General. Seven automatic switchboards. Schedule No. 179. See "Official Notices" to-day.

March 2nd. Sydney Harbour Trust. Circular Quay. Three electrically-operated semi-portal travelling cranes for Berths Nos. 1, 2 and 3, Woolloomooloo Bay. Particulars from Engineer-in-Chief of the Trust.

ADELAIDE.—February 11th. P.M.G. 50 cable terminals. See "Official Notices" to-day.

MELBOURNE.—February 17th. P.M.G. Cable boxes. See "Official Notices" to-day.

Belgium.—January 10th. Belgian Post and Telegraph authorities in Brussels (Salle de la Madeleine). Supply and laying of a quantity of telephone cables in the Antwerp district.

January 24th.—Municipal authorities of Tongres. Extension of the plant at the central electric lighting station in the town.

Bradford.—January 3rd. Corporation. Supply of electric trolley vehicle equipment. See "Official Notices" December 12th.

Brentwood.—January 17th. Petrol-driven electric lighting plant (50 lights) for Branch Asylum, Harold Court, Harold Wood. See "Official Notices" to-day.

Canada.—OTTAWA. January 15th. The General Superintendent of the Government Telegraph Service, Public Works Department, Ottawa, is inviting tenders for 10 knots of submarine cable (gutta-percha, four conductors) and 14 knots (gutta-percha, two conductors). Deposit 10 per cent. with tender. Specification, &c., may be seen and obtained at the C.I. Branch of the Board of Trade, in London.

Dundee.—January 30th. Corporation (*a*) 5,000-KW. steam turbine and alternator; (*b*) condensing plant; (*c*) 750-KW. rotary converter, with transformer. See "Official Notices" to-day.

France.—January 8th. French State Railway authorities in Paris (42, Rue de Chateaudun). Supply of two batteries of accumulators at the sub-station at Asnières, and the maintenance of same during 15 years.

Halifax.—Corporation. Ten miles of trolley wire. Town Clerk (Mr. Percy Saunders), Town Hall, Halifax.

Ipswich.—January 31st. Corporation. (*a*) Three-phase 300 K.V.A., 3,300-volt alternator, rotary converter with transformer, A.C. booster and C.C. exciter, automatic voltage regulator and booster, cable connections. (*b*) Three 50-K.V.A. three-phase transformers. (*c*) H.T. three-phase main switchboard. (*d*) H.T. and L.T. switchgear. (*e*) Two motor or rotary converters, each 250 KW. See "Official Notices" to-day.

London.—L.C.C.—January 13th. Installation of 130 lighting points at Popham Road Elementary School, South Islington. See "Official Notices" December 19th.

January 20th and 21st. Installations at Vernon Square Elementary School, Finsbury, E.C. (241 wiring points and 318 lights), and at Raneleigh Road Elementary School, Pimlico, S.W. (210 wiring points, 258 lights). See "Official Notices" to-day.

ISLINGTON.—January 28th. Corporation. Twelve months' supply of electrical and engineers' stores. See "Official Notices" to-day.

G.P.O.—January 5th. Telephone silence cabinets, for the P.M.G. See "Official Notices" November 21st.

Manchester.—January 6th, Tramways Committee. Pitch for paving purposes. Mr. J. M. McElroy, General Manager.

New Zealand.—January 30th. Fielding Borough Council. Two Diesel engines, A.C. generators, 2,400 volts single-phase 50 periods, exciters, switchboard, fuel storage tanks, crane, &c. Further particulars are given in the *Board of Trade Journal*.

Northampton.—January 12th. Corporation. Double line of tramways to Far Cotton and doubling of section of Kingsthorpe route, also the necessary overhead equipment, underground feeders, telephones, &c. Specifications (£5 deposit) from Mr. A. Fidler, Borough Engineer, Guildhall.

Plymouth.—January 19th. Corporation. Twelve months' supply of arc lamp carbons, electricity meters, transformers, cables, &c. See "Official Notices" to-day.

Salford.—January 12th. Corporation. Three-phase extra high-pressure and medium-pressure switchgear, also two 300-K.V.A. three-phase power transformers. See "Official Notices" to-day

Spain.—The municipal authorities of Valdepenas de la Sierra (province of Guadaljara) have just invited tenders for the concession for the electric lighting of the town during a period of 10 years.

St. Albans.—January 14th. Electric light installation, Workhouse, for the B.G. Mr. E. F. W. Hicatt, Clerk, Chequer Street.

St. Helier (Jersey).—Corporation. Concession for the supply of electrical energy for light, heating and power. (Population 26,000.) See "Official Notices" to-day.

Swansea.—January 8th. Corporation. One or two years' supply of motors and starting switches. See "Official Notices" December 19th.

Wolverhampton.—January 19th. Corporation. Two water-tube boilers complete with superheaters and mechanical stokers. See "Official Notices" to-day.

CLOSED.

Aldershot.—The U.D.C. has accepted the tender of Callender's Cable and Construction Co., Ltd., for cable needed for extensions to Eggar's Hill.

Australia.—Queensland Railways Department. Electric lamps for two years, from January 1st, 1914. The Edison & Swan U.E.L. Co., Ltd.—*Tenders.*

N.S.W. Ports and Harbours.—Four electric motors, £133. Siemens Bros. Dynamo Works, Ltd.—*Australian Mining Standard.*

Batley.—It is stated that the Electricity Committee has accepted the tender of the Brush Electrical Engineering Co., for a 1,200-KW. Ljungstrom turbo-generator.

Bedford.—The Borough Education Committee has appointed Messrs. James & Sons contractors for carrying out the electrical work for the ensuing half-year.

Belgium.—Six firms—four Belgian and two German—submitted tenders to the Belgian Post and Telegraph Authorities for the supply and installation in the basement of the G.P.O. in Brussels, of three air compressors and three vacuum pumps, all to be electrically operated. The lowest tender was that of Messrs. H. F. Dencker, of Ixelles, Brussels.

Bingley.—The U.D.C. has accepted the following tenders:—

Western Electric Co., Ltd.—Laying of services.
Carr & Co.—Wiring of Town Hall and premises (excluding the public baths).

Canada.—MONTREAL.—A contract has been awarded the Canadian General Electric Co., by the Montreal and Southern Counties Railway Co., for the electrical equipment of the Rougemont sub-power station; and one has been given to the Canadian Westinghouse Co., of Hamilton, for the electrical equipment of an order of cars, from the National Steel Co., for the Montreal and Southern Counties Railway Co. The town of Neepawa (by its consulting engineers, W. E. Skinner, Ltd.), has ordered from the Canadian General Electric Co. one 150-K.V.A., 450 R.P.M., 2,400-volt three-phase, 60-cycle, A.C. generator.—*Canadian Engineer.*

Dover.—The following tenders were received by the T.C. for installing electric light in the Barton Road Schools:—

J. Wright & Sons	£85
R. W. Robson	£66 (alternative £64)
E. A. Pinto	£65 (alternative £63)
V. P. Martin	£51

East Grinstead.—The U.D.C. has provisionally accepted, subject to the sanction of the L.G.B. to a loan, the tender of Messrs. Heenan & Froude for a refuse destructor, at £2,896.

Hull.—The B. of G. has accepted the tender of Messrs. Clarke & Graham, for the supply of electrical goods for the next three months.

London-Brighton.—Messrs. Johnson & Phillips, Ltd., recently secured the order for manufacturing and laying a new trunk telephone cable between London and Brighton, a distance of 53 miles, and have now commenced the work of drawing-in.

Mynachdy Colliery.—The Mynachdy Colliery Co. has placed an order with Messrs. Johnson & Phillips, Ltd., for the supply and erection of complete 11,000-volt sub-station equipment and overhead line, also L.T. mining type switchgear, transformers and cables.

Stoke-on-Trent.—The T.C. has accepted the tender of Messrs. David Rowell & Co. for expanded metal screens for the electricity works.

Weaverham.—Messrs. Johnson & Phillips have in hand for the Weaverham E.S. Co., a complete generating station equipment, comprising gas-driven generating set, motor-alternators, step-up transformers, H.T. and L.T. switchgear; also high and low-tension underground and overhead cables.

Worksop.—The order for the wiring of the workhouse has been placed with Mr E. W. Shotton, Worksop, at £108.

FORTHCOMING EVENTS.

Electro-Harmonic Society.—Friday, January 2nd. At Holborn Restaurant. Smoking Concert.

Junior Institution of Engineers.—Friday, January 2nd. At 8 p.m. At 39, Victoria Street, S.W. Paper on "Electric Cooking." By Mr. E. J. Hazelton.

Rontgen Society.—Monday, January 5th. At 8.15 p.m. At Middlesex Hospital, Mortimer Street. Paper on "Histological Changes produced by X-rays on Animal Tissues; Destructive and Hyperplastic Action of X-rays; Practical consequences in regard to Radio-Therapy and protection of the Radiologist," by Dr. Jean Clunet.

Institution of Electrical Engineers (Manchester Students' Section).—Tuesday, January 6th. At 7.30 p.m. At Municipal School of Technology, Paper on "D.C. Power in the Machine Shop," by Mr. E. Blackmore.

Royal Institution of Great Britain.—Tuesday, January 6th and 8th. At 3 p.m. At Albemarle Street, W. Continuation of Lectures to Juniors on "A Voyage in Space," by Prof. H. H. Turner.

Royal Society of Arts.—Wednesday, January 7th. At 5 p.m. At John Street, Adelphi. Juvenile Lecture on "Electric Vibrations and Wireless Telegraphy," by Mr. R. P. Howgrave-Graham.

Batti-Wallahs' Society.—Wednesday, January 7th. At 7 p.m. At Victoria Mansions Restaurant. Informal Meeting.

Institution of Civil Engineers of Ireland.—Wednesday, January 7th. At 8 p.m. At Dublin. Ordinary Meeting.

Institution of Electrical Engineers (Birmingham Local Section).—Wednesday, January 7th. At 7.30 p.m. At the University, Edmund Street. Paper on "The Development of Electric Power for Industrial Purposes in India," by Mr. H. R. Speyer.

Institution of Electrical Engineers.—Thursday, January 8th. At 8 p.m. At Victoria Embankment, Paper on "British Practice in the Construction of High-Tension Overhead Transmission Lines," by Mr. B. Welbourn.

Concrete Institute.—Thursday, January 9th. At 7.30 p.m. At Denison House, 296, Vauxhall Bridge Road, S.W. Paper on "Factory Construction," by Mr. P. M. Fraser.

Greenock Electrical Society.—Friday, January 9th. At 7.45 p.m. At Temperance Institute, West Stewart Street. Papers on "Thoughts on Cable Chemistry," by Mr. Lowrie Sinclair, and "Cable Faults and their Causes," by Mr. L. Hogg.

Junior Institution of Engineers.—Friday, January 9th. At 8 p.m. At 39, Victoria Street. Paper on "The Future of the Institution," by Mr. C. H. Woodfield.

Saturday, January 10th. Visit Works in progress at London Docks for the Port of London Authority.

Manchester Association of Engineers.—Saturday, January 10th. At Grand Hotel, Aytoun Street, Manchester. Paper on "Transmission of Power by Chains," by Mr. H. T. Hildage.

THE ELECTRICAL ENGINEERS
(LONDON DIVISION).

Commanding Officer—LIEUT.-COL. H. M. LEAF.

The following orders have been issued:—

Monday, January 5th.—"A" Company. Technical instruction, 7 p.m. to 10 p.m.

Tuesday, January 6th.—"B" Company. Ditto.

Wednesday, January 7th.—Recruits only. Infantry drill and technical instruction, 7 p.m. to 10 p.m.

Thursday, January 8th.—"C" Company. Technical instruction, 7 p.m. to 10 p.m.

Friday, January 9th.—"D" Company. Technical instruction, 7.30 to 9.30 p.m. Special class on Crossley engine, 7 to 8 p.m.

Saturday, January 10th.—Headquarters will be opened for regimental business only from 10 a.m. till 12 noon.

(Signed) F. R. HOLT-WHITE, Capt. R.E., Adjutant.
For Officer commanding L.E.E.

NOTES.

Provisional Orders.—The B. of T. has issued its usual list of applications for provisional orders deposited on or before December, 1913, for consideration in the 1914 session. Names of promoters and names and addresses of agents appear in tabular form.

International Electrical Congress, San Francisco, 1915.—The International *Electrical* Congress is to be held at San Francisco, September 13th to 18th, 1915, under the auspices of the American Institute of Electrical Engineers by authority of the International Electrotechnical Commission, and during the Panama-Pacific International Exposition. Dr. C. P. Steinmetz has accepted the Honorary Presidency of the Congress. The deliberations of the Congress will be divided among 12 sections, which will deal exclusively with electricity and electrical practice. There will probably be about 250 papers. The first membership invitations will be issued in February or March, 1914. Attention is drawn to the distinction between this Electrical Congress and the International *Engineering* Congress, which will be held at San Francisco during the week immediately following the electrical congress. The engineering congress is supported by the Societies of Civil, Mechanical and Marine Engineers, and by the Institutes of Mining and Electrical Engineers, as well as by prominent Pacific Coast engineers who are actively engaged in organising it. This Congress will deal with engineering in a general sense, electrical engineering subjects being limited to one of the 11 sections, which will include about 12 papers, treating more particularly of applications of electricity in engineering work. The meeting of the International Electrotechnical Commission will be held during the week preceding the Electrical Congress

The Electrical Engineers' Ball, 1914.—Notwithstanding the increase of social engagements which during the winter season make their appeal to the members of electrical institutions and societies and to others interested in the electrical profession and industry—dinners, concerts, conversazioni, informal evenings, and so on—the Electrical Engineers' Ball continues to hold a place quite apart from all the rest as an evening when, with complete unanimity, all give themselves up to enjoyment, and forget for the time being that there are such things as professions and industries. How representative the function is may be gathered from the following list of members of the Committee for the next Ball, which is to take place at the Hotel Cecil on Friday, February 20th. Those who take part in the evening, and in the organisation of the arrangements connected therewith, do so with the idea of providing an evening's enjoyment of such a class and character as is afforded by no other fixture of the season, and in this they have hitherto always been successful.

Alabaster, H.	Gray, R. Kaye	Railing, M. J.
Anderson, A. Bruce	Hadley, A. E.	Roberts, Martin F.
Bailey, F.	Hawes, F. B. O.	Robinson, Leonard L.
Baldwin, O. H.	Hill, Charles	Rosenthal, J. H.
Belfield, R.	Highfield, J. S.	Rowell, P. F.
Berry, H. H.	Hirst, H.	Rutherford, W.
Blunt, W. W.	Holden, Col. H. Capel	Sharp, Sydney
Bowden, J. H.	Hooper, J. P.	Shepherd, J.
Brown, D. A.	Hunter, C. E.	Siemens, Alex.
Byng, Leonard	Kingsbury, J. E.	Sillar, A. M.
Callender, T. O.	Leaf, H. M.	Scholey, H.
Colton, C. S.	Lonsdale, W. S.	Smith, Frederic
Davenport, F. R.	MacKay, H. T. S.	Sparks, C. P.
Dobson, Sydney	Madgen, W. L.	Steinitz, J. J.
Elder, T. C.	Matthews, W. Lee	Sutton, G.
Ferranti, S. Z. de	Mordey, W. M.	Taite, C. D.
Fox, E. J.	McMahon, P. V.	Taylor, J.
Garcke, E.	Murray, Lee	Taylor, Godfrey M. C.
Gatehouse, T. E.	Nalder, F. H.	Wallis-Jones, R. J.
Geipel, K.	Nash, E. A.	Willcox, F. W.
Geipel, Wm.	O'Meara, Major	Wilson, Prof. E., F.R.S.
Gray, Jas.	Pearson, Hugh A.	Wordingham, C. H.

Executive Committee.—Baldwin, O. H.; Fox, E. J.; Madgen, W. L.; McMahon, P. V.; Shepherd, J.; Wallis-Jones, R. J.; and Wordingham, C. H.

Hon. Secretaries.—Alabaster, H.; Sillar, A. M.

Hon. Treasurer.—Kingsbury, J. E.

Institution and Lecture Notes.—INSTITUTION OF CIVIL ENGINEERS.—At a Students' Meeting on December 19th, Mr. W. E. Gurry, Stud.Inst.C.E., read a paper entitled "Air Filtration and the Cooling and Ventilating of Electrical Machines." The chair was taken by Mr. J. S. Highfield, M.Inst.C.E.

INSTITUTION OF ELECTRICAL ENGINEERS.—The following is the programme of the NEWCASTLE LOCAL SECTION for the second half of the session 1913-14:—

January 12th.—"British Practice in the Construction of High-Tension Pole Lines," by D. Welbourn.

January 26th.—"Inductance and Inductance Coils for Industrial Work," by E. F. Hollis.

February 9th.—"The Need for a Testing Authority," by W. Aitken. (This paper will be read privately.)

February 23rd.—"Some Railway Conditions governing Electrification," by E. T. Smith.

March 16th.—"Suggested Methods of Improving the Telephone Service," by C. Turnbull.

April 6th or 13th.—Address and Demonstration, "Electric Furnaces," by V. Stobie.

May 4th.—"Electric Heating and Cooking," by W. A. Gillett.

May 26th.—Annual general meeting. Paper to be decided later.

On Friday, the 19th ult., the BIRMINGHAM LOCAL SECTION held its seventh annual dinner at the Grand Hotel, Mr. A. M. Taylor being in the chair. Among the guests present were the Lord Mayor of Birmingham (Lieut.-Col. Martineau), Mr. Hartnell, chairman of the Yorkshire Section I.E.E., Mr. Home-Morton, chairman of the Birmingham Mechanical Engineers, and others. The Corporation electric supply department was represented by Mr. R. A. Chattock. A most enjoyable evening was spent, and the dinner was followed by an entertainment.

The toast of "The King" having been duly honoured, the chairman proposed "The Institution of Electrical Engineers." He said the Institution was not only one in which the community had great confidence, but also one representing many interests. There were telegraph and telephone engineers, mains engineers, bulk supply engineers, and tramway engineers. He hoped before long to see the general electrification of the main long-distance railway lines. Besides these there were the engineers engaged in electric furnace work and in electrochemical processes, as well as manufacturing engineers. All classes were equally looked after by the Institution, and were united by a common bond of interest. The Institution was originally formed to deal with telegraph engineering, but its range of subjects had now widened considerably. Some of those present dealt with currents so enormous that they could melt bars of copper and steel, while some others dealt with the feeble currents of wireless telegraphy. He wished to put before them the great quantity of work that fell to the lot of the President of such an

Institution as the I.E.E. The position was no sinecure. Apart from his own consulting work, which was anything but small, the President had to perform many duties. He presided over the meetings of no fewer than 28 Committees, besides being present at the various meetings at which papers were read. The speaker, therefore, had much pleasure in coupling with the toast the name of Mr. Duddell. The President, in responding, said he felt that the Institution had the interests of the electrical engineering profession at heart. With regard to the electrification of the main lines of railway, referred to by the previous speaker, the I.E.E. had arranged for a series of papers to be given dealing with the difficulties met with, and the best ways of overcoming them. He hoped to see the cost of steam-generated power much reduced in the near future, so that we should be in a position to compete with other countries where cheap water-power was obtainable, especially in the electrochemical and electrometallurgical manufactures, and thus to regain what little ground we had lost.

Mr. J. F. C. Snell (Vice-president I.E.E.), in proposing "The Birmingham Local Section," said that in Birmingham the engineering profession had many interests. Great credit was due to the city electrical engineer, Mr. Chattock, and his staff for the way in which they had succeeded in reducing the cost of energy in Birmingham. The local sections of the I.E.E. were a source of strength to the Association. Dr. A. H. Railing replied in a humorous vein. He assured Mr. Snell that they took a lively interest in the proceedings of the Institution in London, not only when they agreed with them, but, as in the case of the revision of the I.E.E. articles, when they did not. The speaker said that Birmingham was most favourably situated as an engineering centre, with coal and iron close at hand in abundance. It was therefore up to the engineers in the district to make the most of their advantages, for the sake of Birmingham, the country generally, and themselves.

The toast of "Our Guests" was then proposed by Mr. R. A. Chattock, who thanked the previous speakers for their kind references to himself and his staff. He said that cheap electrical power was the life-blood of the nation, without which it could not hold its own against other countries. He himself advocated the national centralisation of power, and considered the cost of generating could be much reduced thereby, to the great advantage of manufacturers. He also touched upon the benefits of electric accumulator vehicles from the central station engineer's point of view, and pointed out that the charging of batteries for these conveyances would provide a useful day load. The Lord Mayor, in reply, said that in his school days the study of electricity had not yet penetrated the public schools, and he therefore looked with some awe upon the controllers of this mysterious force, but felt relieved to find that they had dinner just like ordinary people. He regarded cheap electricity as a means to attract traders to the city and to abate the smoke nuisance.

Mr. Solomon, in a brief and amusing speech, proposed the health of "The Chairman," Mr. Taylor, who replied.

The proceedings closed with a vote of thanks to the local hon. secretary, Mr. J. D. Morgan, who carried out the whole of the arrangements for the dinner.

ASSOCIATION OF MINING ELECTRICAL ENGINEERS.—At the monthly meeting of the East of Scotland branch, a discussion was held on a paper contributed by Mr. J. P. C. Kivlen on "The Specifying and Buying of Mining Electrical Plant." Mr. W. A. Wilson (British Insulated and Helsby Cables, Ltd.) said it was suggested in the paper that cable makers should manufacture a concentric cable made up with twin or multiple cores. If the demand justified it such a cable would doubtless soon be available, but he feared that the much-enhanced price, due to the high cost of manufacture—especially of small quantities—would nullify any technical advantage it might have. He strongly disagreed with the author's opinion respecting the use of paraffin wax for filling joint boxes. Not only was this material hygroscopic, but it contracted very considerably on cooling—shrinking always towards that portion which remained liquid longest—with the result that the wax shrank, not only from the sides, but also from the fittings or other heat-conducting bodies in the box, so that should water enter it found a clear pathway to the very heart of the cable fittings. Serious results must inevitably happen in course of time if this material were employed. Some little time after paper cables were introduced, the use of paraffin wax for the purpose of filling end connections and so on was absolutely prohibited on account of the unfortunate results obtained. Mr. Sutcliffe (Messrs. Siemens Brothers) maintained that if some rigid form of specification was scrupulously followed, it would be to the mutual interest of users and manufacturers. The discussion was adjourned till next meeting.

At a meeting of the Yorkshire Branch, at Leeds, a paper on "The Choice of Electrical Machinery for Use in Mines," by Mr. J. P. C. Kivlen, was read and discussed.

Under the auspices of the West of Scotland Branch, a public meeting of all those interested in the handling of colliery electrical plant was held in Hamilton Town Hall on December 20th. Mr. D. M. Mowat, general manager of the Summerlee Coal Co., who presided, said that the Association, which was formed in 1909, had already a membership of 1,100 in 10 branches throughout Britain, the West of Scotland Branch being the strongest of all, with 250 members. Mr. Alex. Anderson, president of the Association, delivered a lecture on the "Transmission of Electricity," and an interesting discussion followed.

BATTERSEA POLYTECHNIC, S.W.—A course of advanced lectures on "Generating Stations," by Mr. W. H. Patchell, has been arranged to take place on the following Mondays, at 7.30 p.m.:—January 9th, 26th, February 2nd, 9th, 16th. The lectures will cover the following ground:—Generating Station Design—Choice of site—Choice of system; Prime Movers. Steam—Reciprocating Engines, Turbines; Steam Auxiliaries; Steam Boilers—Gas Engines—Oil Engines; Electric Generators; Lay-out of small Station for Lighting and Power Supply; Lay-out of Large Generating Station. The lectures are intended for advanced students. Admission is free, and no tickets are required.

SOCIETY OF ENGINEERS (INC.).—The Council may award in 1914 a premium to the value of £10 10s., for an approved essay on "The Status of the Engineering Profession." The competition is open to all; particulars can be obtained from the Secretary, 17, Victoria Street, Westminster. The last date for receiving essays is May 30th, 1914.

Appointments Vacant.—Junior shift engineer, for Southport Corporation (25s.); shift engineer, A.C. power station, for Reigate Corporation (28s.); assistant electrical engineer, age 26-33, for Singapore Municipality ($250 month); sub-station shift engineer, for Bristol Corporation (35s.); car-shed superintendent, for Falkirk and District Tramways Co. (£2 10s.). Particulars are given in our advertisement pages.

Fatality.—On Saturday an inquest was opened at Foleshill, Staffs., on the body of George Oliver Randle, 23, an assistant electrician at Exhall Colliery, who was killed electrically whilst at work there on December 23rd.

Dr. L. Orton stated that he was called to the workings of the colliery and saw the body of the deceased. Workmen were trying artificial respiration, although the man had been dead two or three hours. He found an abrasion on the inside of the right thumb and on the back of the fingers of the right hand. The left hand was unmarked, but the face was pallid and the pupils were dilated. From the appearance of the remains the witness concluded that death was due to electrical shock. On examining the cable which deceased was said to have been splicing, he found that the whole of the strand had been severed. The cable was cased, but the copper wire was protruding some inches at either end, and it was evident that the man was making a joint.

Mr. W. Johnson, jun., representing the Warwickshire Miners' Association, thought it would be better to postpone the proceedings until the various representatives were present.

A juryman asked if there were any india-rubber gloves which the deceased could have used while splicing the cable.

The Coroner: We shall get that at the adjourned inquiry. The question is a proper one. For this work proper gloves and mats should be provided.

The inquiry was adjourned.

Copper.—Messrs. Merton's statistical circular gives the situation on December 15th (mid-month). On that date English stocks showed a loss of 84 tons for the fortnight, and French stocks an increase of 160 tons. Afloat from Chile the quantity was less by 325 tons, and from Australia by 650 tons. What are generally known as European supplies show, therefore, a decrease of 899 tons on the fortnight; including Rotterdam, Hamburg and Bremen and estimates for other European ports the decrease is 669 tons. The three German ports show interesting figures, being altogether, at the present time, 5,637 tons.

Supplies for the fortnight show North America low, Spain and Portugal above the average, Chile shipments just on, and Australian rather above the average. Total deliveries low.

American stocks had much appreciated during November, to the extent of 6,859 tons. The world's supply without Holland and Germany for the same date showed 42 877 tons, an increase of 6,989 over the figure for the end of October. The total visible supply is given (end of November) as 48,154 tons, or an increase of 7,789 tons during the month.

X-Ray Developments.—It is reported that a new method of generating X-rays has been discovered by Dr. W. D. Coolidge, of the General Electric Co., U.S.A. A new type of tube is employed, and the rays produced are extremely powerful compared with those obtained by the ordinary methods, while they are under complete control.

Electric Hair Brushes.—Referring to an inquiry in our last issue, the Light Electric Motor Co., Ltd., of Meads Lane, Seven Kings, Essex, inform us that they are the makers of Maclean's patent electric hair brushes. The company entered into an agreement with the late John Maclean in 1905, for the purchase of his patent electric motor hair brush and other electric specialities; the death of Mr. Maclean (who was at the time managing director of the company) took place in 1906, but the machine is still called by some "Maclean's motor hair brush."

Educational Notes.—NORTHAMPTON POLYTECHNIC INSTITUTE.—A special course of six lectures on "Secondary Batteries," by Mr. W. R. Cooper, will be delivered on Wednesday evenings, commencing January 28th. A special course of lectures and laboratory work on "Radio-Telegraphy," by Mr. E. F. Perrin, will also be delivered on Monday and Thursday evenings, from January 26th to May 14th.

CRYSTAL PALACE SCHOOL OF PRACTICAL ENGINEERING.—The new course will commence on Wednesday, January 7th. Particulars are given in our advertisement pages.

KING'S COLLEGE FACULTY OF ENGINEERING.—Special advanced courses are arranged in "Irrigation," by Mr. N. F. Mackenzie, for Thursdays, at 6 p.m., commencing January 15th, and in "Thermo-dynamics," by Mr. J. Swinburne, for Fridays, at 6 p.m., commencing January 30th. First lecture free to public. Particulars are given in our advertisement columns.

The I.E.E. Annual Dinner.—The annual dinner of the Institution of Electrical Engineers is to be held on Thursday, February 5th, in the Grand Hall, Hotel Cecil.

Legal.—DUBLIN COUNTY COUNCIL *v.* POSTMASTER-GENERAL.—Mr. Justice Dodd has given judgment in the Dublin Courts in favour of the defendant in the claim by the Dublin County Council (see ELEC. REV., December 12th, 1913, page 951) that the Postmaster-General was bound to carry out the agreement entered into with the Council by the National Telephone Co. to supply telephone connections and apparatus to the offices of the secretary of the Council, the county surveyor and the solicitor to the Council. His Lordship held that the Postmaster-General was not bound by the conditions and stipulations formerly binding on the Telephone Co.

OUR PERSONAL COLUMN.

The Editors invite electrical engineers, whether connected with the technical or the commercial side of the profession and industry, also electric tramway and railway officials, to keep readers of the ELECTRICAL REVIEW *posted as to their movements.*

Central Station Officials.—On December 20th, Mr. J. W. Beauchamp, engineer and manager of the West Ham Corporation electricity supply, presented MR. W. T. HELLABY, late superintendent of the Representatives' Department, with a marble clock, on behalf of the staff and employés, on the occasion of his leaving to take up his appointment as assistant sales manager for the Sunderland electricity undertaking. Mr. Beauchamp made brief reference to the good work done by Mr. Hellaby in furthering the interests of the sales department, and Mr. Hellaby suitably responded. In the evening a farewell dinner was given to Mr. Hellaby at Frascati's Restaurant. Mr. F. Farndon, sales manager of the West Ham Corporation electricity undertaking, presided, and among the visitors were Mr. Councillor Kensett; Messrs. Sumner Smith (the British Electric Equipment Co., Ltd.); W. E. Bull (Falk, Stadelmann & Co., Ltd.); E. P. Barfield (the Edison & Swan Electric Light Co., Ltd.); Mr. Bardell (Siemens Bros. Dynamo Works, Ltd.); Messrs. Goldby and Yates (Messrs. Gillespie & Beales, Ltd.), and Mr. Clark (of Johnstone & Cumbers), Sugar House Lane, Stratford.

The marriage took place on December 22nd, at St. John's Episcopal Church, Perth, of MR. R. S. SMITH, shift engineer at Perth Electricity Works, to Miss Isabella Powrie.

MR. W. GEO. STOCK has been appointed assistant engineer at the electricity works, Hindhead.

MR. ALEX. FRASER, electrical and mechanical engineer, Aberdeen, has been appointed sales engineer for Scotland for Messrs. Siemens Brothers Dynamo Works. Glasgow will be his headquarters. Mr. Fraser has held for the past three years the position of engineer-in-charge at the power station of the Glasgow Corporation electricity department.

MR. H. E. MUNDAY, of Devonport Dockyard electric power station, has been appointed charge engineer at the Cheltenham Corporation electricity works.

MR. PERCY HALE, who is leaving the Buxton electricity works to take up another appointment, has been presented by the staff with a fountain pen. The presentation was made by Mr. G. W. Botting, chief assistant.

The Faversham T.C. has appointed MR. G. SUMMERVILLE, borough electrical engineer, to supervise all the electrical machinery at the sewage ejector and main pumping stations at a salary of £20 a year, with a grant of £20 for services already rendered.

The Morecambe T.C. has appointed MR. A. W. ANNETTS as electrical engineer at a salary of £150 per annum, and to retain for three months, at a monthly salary of £3 3s., the services of MR. L. B. HOGARTH, who is leaving for Whitehaven, as advisory engineer.

The Erith U.D.C. has decided to increase the salary of the electrical engineer and tramways manager from £350 to £400 per annum as from November 17th.

The Newport (Mon.) Electricity Committee has granted a bonus of 25 guineas to the borough electrical engineer (MR. NICHOLS MOORE), and 10 guineas to the deputy engineer (MR. THAINE) in recognition of services rendered in installing the new plant. A sum of 25 guineas is to be divided amongst the workmen.

Stoke-on-Trent T.C. has appointed MR. P. D. WRIGHT, of Paisley, as switchboard attendant at the Stoke works.

When a recommendation was made at the last meeting of the Dunkalk Urban Council that MR J. M'ENTEE, Belfast, be appointed assistant electrical engineer at an initial salary of £100 a year, Mr. J. M. Johnson protested against the "over-weighting of the electric undertaking by the creation of jobs." Mr. P. A. Spalding, chief engineer, said there was no electric station in the kingdom with the same output as Dundalk that had not the services of an assistant engineer. The appointment was carried by 10 votes to 3.

MR. A. J. BECKETT, borough electrical engineer at Bridlington, has resumed his duties on recovery from an illness. At a meeting of the T.C. on December 22nd, the Mayor expressed gratification at seeing Mr. Beckett in his place again, and expressed a hope that he would soon be quite restored to health.

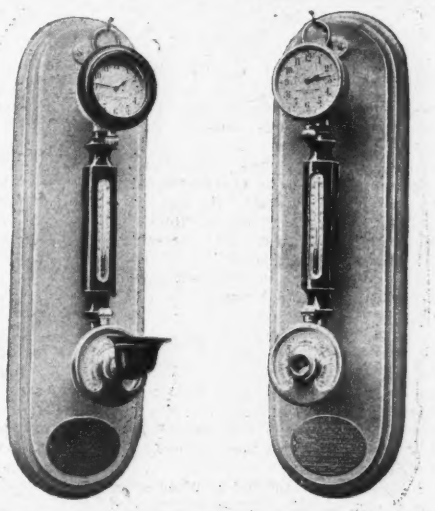
MR. E. S. RILEY, of Hull, has been appointed assistant on the engineering staff at the Walthamstow electricity works, at a salary of £150 per annum. MR. A. D. AXFORD, of Dover, has also been appointed assistant in the department's showroom.

MR. J. FITZGERALD, after eight years' service with the Bristol Corporation electricity department as assistant engineer in various departments, is taking up a position as representative engineer in the Bristol branch of Simplex Conduits, Ltd.

The Rochdale Electricity Committee has recommended an increase of £50 a year in the salary of the electrical engineer, bringing it up to £500 per annum.

Tramway Officials.—MR. J. W. BLAKEMOOR, chief traffic clerk to the Salford Corporation Tramways, has been recommended for appointment to the post of traffic superintendent. It was also recommended that MR. F. ELLWOOD be appointed chief traffic clerk.

General.—On Saturday, December 20th, at the Guernsey State Telephone Offices practically the whole telephone staff and Council were present at an interesting function. The first retiring president of the Council, MAJOR-GENERAL F. B. MAINGUY, was presented with a souvenir as a token of the appreciation in which he has been held by the Council and staff during his 15 years' chairmanship of the department. Major-General Mainguy, it is stated, was the promoter and main mover in the scheme for providing Guernsey with a State-owned telephone system. The chair was occupied by Jurat J. Esten de Jersey (the actual president), and an appropriate address was made by Mr. R. McLean, the resident manager and engineer, respecting the history of telephony in Guernsey, and the important service



GUERNSEY TELEPHONE PRESENTATION. THE RIGHT-HAND ILLUSTRATION SHOWS THE EAR-PIECE AND MOUTH-PIECE REMOVED.

rendered in connection with it by Major-General Mainguy, and expressing the great regret of all that he had decided to retire from the presidency of the Telephone Council. Jurat de Jersey then presented a wallet containing a telephone handset of novel and ingenious design—comprising a timepiece, barometer and thermometer. We give illustrations showing this unique present, the metal parts of which are in oxidised silver, the whole set being mounted on a walnut base.

DR. EMIL RATHENAU, the moving spirit of the Allgemeine Electricitäts Gesellschaft, of Berlin, celebrated his 75th birthday on December 11th last. Congratulations!

MR. ROLAND F. HUGHES, at present with Messrs. Chamberlain and Hookham, Birmingham, has received an appointment as chief tester in the meter and instrument department of the British Westinghouse Co., Ltd., Manchester.

MR. DAY, of the electrical department, Surrey Commercial Docks, Port of London Authority, has been presented with an electrical engineering dictionary, on the occasion of his resigning to take up the position of electrician at the University of Hong Kong.

We read in the *Times* that PROF. SILVANUS P. THOMPSON has been elected a corresponding member of the Academy of Sciences of Bologna.

According to the *Canadian Electrical News*, PROF. L. A. HERDT, of McGill University, has been appointed by the city of Quebec to advise on electrical conditions in that city.

It is stated in a daily paper that MR. THOMAS PARKER is resigning his seat on the board of the Metropolitan Railway Co.

Just as we go to press the list of New Year Honours is announced. A baronetcy has been conferred upon MR. WM. BEARDMORE, chairman of the well-known firm of engineers, &c.—Wm. Beardmore & Co., Ltd.; the honour of knighthood has been conferred upon PROF. ERNEST RUTHERFORD, F.R.S., of Manchester University, whose brilliant work in chemical science, and particularly his researches in radio-activity, are well known to our readers; geological science is honoured by the appointment of SIR ARCHIBALD GEIKIE to the Order of Merit; MR. W. T. FRANKS, Comptroller-General of Patents, &c, is made a C.B. in the Civil Division; and MR. U. F. WINTOUR, Director of the Board of Trade Exhibitions Branch is in the Foreign Office honours for appointment as a C.M.G. To all of these we offer our hearty congratulations.

Will.—The late SIR W. H. BAILEY left £68,313 gross and £37,394 net personalty.

NEW COMPANIES REGISTERED.

British Central Electrical Co., Ltd. (132,783).—This company was registered on December 15th, with a capital of £3,000 in £1 shares, to take over the business carried on by E. S. Conradi and J. F. Conradi at 6-8, Rosebery Avenue, E.C., as the "British Central Electrical Co.," and to carry on the business of electrical engineers and contractors, suppliers of electricity, electric manufacturers, dealers in electric, magnetic and galvanic apparatus, &c. The subscribers (with one share each) are:—E. S. Conradi, 6 and 8, Rosebery Avenue, E.C., electrical engineer; J. F. Conradi, 6 and 8, Rosebery Avenue, E.C., electrical engineer. Private company. E. S. Conradi and J. F. Conradi are permanent governing directors, subject to holding three-fifths of the ordinary share capital. Registered by J. Hands, 97, Gresham Street, E.C.

Trans-Oceanic Wireless Telegraph Co., Ltd. (132,843).—Registered December 17th, by Coward & Hawksley, Sons & Chance, 80, Mincing Lane, E.C. Capital, £200,000, in £1 shares. Objects: To acquire from Marconi's Wireless Telegraph Co., Ltd., certain lands, hereditaments and rights in the counties of Carnarvon and Merioneth, together with the wireless station in course of erection thereon, and a sole licence to use the patents of the vendor company for purposes of direct wireless communication between Great Britain and certain stations in the U.S.A., to work, carry on, develop and turn to account the said property, rights, station and licence, to carry on the business of proprietors, managers of and dealers in telegraphic and telephonic works, systems, lines, stations and exchanges, electricians, manufacturers, generators, accumulators, suppliers and distributors of electricity for telegraphic and telephonic communications (whether wireless or otherwise) and for lighting, heating, traction and motive power purposes, receivers, transmitters, carriers and distributors of telegraphic and telephonic messages, telegrams, news and intelligence, managers, conductors and performers of all business and service connected therewith, and with telegraphic and telephonic communications, &c. The signatories (with one share each) are:—H. W. Allen, 51, Braxted Park, Streatham Common, S.W., chartered secretary; H. W. Corby, 84, Cecile Park, Crouch Hill, N., chartered secretary. Private company. The first directors (to be not less than three or more than 10) are Guglielmo Marconi, Marconi House, Strand, W.C.; Godfrey Charles Isaacs, 7, Hanover Terrace, Regent's Park, N.W.; Capt H. R. Sankey, 7, Charlby Grove, Ealing, W.; and M. A. Braunstein, Norfolk House, Norfolk Street, W.C.; qualification, £100: remuneration, £2,000 per annum, and a further £500 per annum for every 5 per cent. dividend in excess of 7 per cent. (maximum in any year £3,000) divisible. Registered office, Marconi House, Strand, W.C.

Colston Electrical Works, Ltd. (132,853).—This company was registered on December 18th, with a capital of £3,500 in £1 shares (1,000 6 per cent. cumulative preference), to take over the business of electrical engineers carried on by G. J. T. J. Parfitt and W. J. Webber, as "Parfitt, Webber & Co.," at 9-10, Denmark Street, Bristol. The subscribers (with one share each) are:—E. W. Brock, Priory Road, Keynsham, glass tile manufacturer; A. E. Finch, 57, Orchard Street, Weston-super-Mare, electrical engineer. Private company. The number of directors is not to be less than two or more than seven; the first are Miss H. L. W. Parfitt, E. W. Brock and A. E. Finch. Registered by Wansboroughs & Co., Lion Chambers, Broad Street, Bristol.

Aladdin Lamp Syndicate, Ltd. (132,887).—This company was registered on December 19th, with a capital of £3,000 in 2,700 ordinary shares of £1 each, and 6,000 deferred shares of 1s. each, to acquire from Baron Adolphe Ott von Batorkez und Verinkhaz, of 3, Perham Road, West Kensington, inventions relating (*a*) to a machine for cutting glass bulbs, and for regenerating electric and other lamps; and (*b*) to an improved metallic-filament lamp, both protected by French patents. The subscribers (with one share each) include G. P. Almond, Avoca Lodge, Village Road, Middlesex, mining engineer. Private company. The directors are to number not less than two or more than five. Baron Adolphe Ott may either become a director, or nominate one director; G. P. Almond signs as a director. Registered office, 6, Moorgate Street, E.C.

Electrical Services, Ltd. (132,856).—This company was registered on December 18th with a capital of £1,000 in £1 shares, to carry on the business of electrical, mechanical and motor engineers, manufacturers of and dealers in motor vehicles, mechanical, electrical, magnetic, telegraphic, telephonic and other appliances, &c. The subscribers (with one share each) are:—E. Muff, 9, Aldermanbury, Bradford, stuff manufacturer; L. V. B. Burrows, 50, Horton Lane, Bradford, electrical engineer. Private company. The number of directors is not to be less than two or more than five; the first are not named. Solicitor, C. T. Rhodes, 3, Commercial Street, Halifax. Registered office, 48, Tunbridge Road, Bradford.

Wessex Engineering Co., Ltd. (132,916) — Registered December 19th, with a capital of £20,000 in £1 shares, to acquire certain British and foreign patent rights of and relating to improvements in internal combustion engines together with the plans, drawings, models, moulds, appliances and other accessories, to carry on the business of manufacturers of and dealers in motor cars, carriages, cycles, omnibuses, tramcars, airships and other vehicles for aerial navigation, gasoline, oil, petrol, electric and steam engines, &c., and to adopt agreements (*a*) with the B. and D. Syndicate, Ltd., M. E. Dunscombe, F. B. Bond and H. J. Howard relating (*inter alia*) to the acquisition of certain patents, inventions and rights referred to therein, and (*b*) with Prof. W. Morgan relating to management. Minimum cash subscription, seven shares. The first directors are the Hon. E. Fielding, A. A. Allen, M.P., Prof. W. Morgan, B.Sc., J. A. Bartlett and W. Yatman; qualification, £100. Registered by Warren, Murton and Miller, 45, Bloomsbury Square, W.C.

OFFICIAL RETURNS OF ELECTRICAL COMPANIES.

Pacific and European Telegraph Co., Ltd. (36,683).—Capital, £100,000, in £10 shares. Return dated November 25th, 1913. All shares taken up. £40,000 (£4 per share paid). Mortgages and charges: £68,600.

Montevideo Telephone Co., Ltd. (27,208).—Capital, £160,000, in 87,000 pref. and 73,000 ord. shares of £1 each. Return dated November 13th, 1913. 86,492 pref. and 72,680 ord. shares taken up. £159,172 considered as paid. Mortgages and charges: Nil.

Rangoon Electric Tramway and Supply Co., Ltd.—Trust deed, dated November 13th, 1913, to secure £300,000 deb. stock, with a premium of 5 per cent. upon redemption, charged on freehold and leasehold property, and the company's undertaking and other assets, present and future, including uncalled capital, subject to prior charges. Trustees: Sir John G. Hill, 10, Water Street, Liverpool; and Sir John Harmood-Banner, 24, North John Street, Liverpool.

Telephos Domestic and Street Lighting Co., Ltd.—Particulars of £10,000 7½ per cent. first mortgage debs., created October 23rd, 1913, filed pursuant to Sec. 93 (3) of the Companies' (Consolidation) Act, 1908, the amount of the present issue being £8,000. Property charged: The company's undertaking and property, present and future, except uncalled capital. No trustees.

United Electric Tramways of Monte Video, Ltd.—The Court has ordered that the particulars filed on January 13th, 1909, of a series of debentures created by the company, be rectified by the substitution of the figures "£100,000" in lieu of "£200,000." (The figures related "to the amount of the present issue.")

Magneta Time Co., Ltd.—Debenture dated December 10th, 1913, to secure £500, charged on the company's undertaking and property, present and future, including uncalled capital. Holder: Miss M. D. Fox, 108, Philbeach Gardens, S.W.

New Phonopore Telephone Co., Ltd. (44,654).—Capital, £10,000 in £1 shares (9,000 ordinary and 1,000 founders): return dated November 14th, 1913; 7,141 ordinary and 1,000 founders' shares taken up, £1 per share called up on 6,741 ordinary, £6,781 paid, leaving £10 in arrears; £1,400 considered as paid on 400 ordinary and 1,000 founders'. Mortgages and charges: At date of return, £3,700; since registered: mortgage for £500 and further advances not exceeding £1,500.

Venezuela Telephone and Electrical Appliances Co., Ltd. (31,304). Capital, £85,000 in 70,000 ordinary shares of £1 each and 1,500 preference shares of £10 each. Return dated December 2nd, 1913. 70,000 ordinary and 860 preference shares taken up, £1 per share called up on 13,494 ordinary and £10 on 860 preference, £22,094 paid. £56,506 considered as paid on 56,506 ordinary. Mortgages and charges: £200,000.

New St. Helens and District Tramways Co., Ltd. (59,426).—Capital, £150,500, in 20,000 preference and 10,000 ordinary shares of £5 each. Return dated November 14th, 1913, 15,980 preference and 9,000 ordinary shares taken up, £5 per share called up, £125,410 paid, including £510 on 1,020 forfeited shares. Mortgages and charges: Nil.

Electric Reduction Co., Ltd. (54,724).—Capital, 40,000 in 16,200 preference and 23,800 ordinary shares of £1 each. Return dated November 13th, 1913, all shares taken up, £1 per share called up on 13,000 preference, £13,000 paid, £27,000 considered as paid on 3,200 preference and 23,800 ordinary. Mortgages and charges: £5,000.

W. Sisson & Co., Ltd. (82,295).—Capital, £25,000 in £1 shares (5,000 pref., 13,000 ord., and 7,000 def.); return dated September 16th, 1913; 3,375 pref., 11,701 ord., and 7,000 def. shares taken up; £1 per share called up on 3,375 pref. and 6,251 ord.; £9,626 paid; £12,450 considered as paid on 5,450 ord. and 7,000 def. Mortgages and charges: Bank overdraft limited to £5,000 (actual amount at date of return, £4,615 11d.).

Chesham Electric Light and Power Co., Ltd. (90,833).—Capital, £25,000 in £1 shares; return dated September 8th, 1913; 15,007 shares taken up; £7 paid; £15,000 considered as paid. Mortgages and charges: £10,000.

Delhi Electric Tramways and Lighting Co., Ltd. (88,758).—Issue on December 15th, 1913, of £3,500 "bearer" debs., part of a series of which particulars have already been filed.

Cross & Cross, Ltd. (105,754).—Capital, £2,000 in £1 shares. Return dated July 2nd (filed September 27th), 1913. 920 shares taken up. £765 paid. £155 considered as paid. Mortgages and charges: £600.

Yarmouth (I.W.) Electricity Supply Co., Ltd. (56,884).—Capital, £5,000 in £5 shares. Return dated October 29th, 1913. 361 shares taken up. £1,805 paid. Mortgages and charges: Nil.

Brown, Boveri & Co., Ltd. (89,167).—Capital, £50,000 in £5 shares (1,500 "A" and 8,500 "B"); return dated December 6th, 1913; all shares taken up; 15s. per share called up on 8,500 "B" £6,375 paid; £7,500 considered as paid on 1,500 "A." Mortgages and charges: Nil.

Consolidated Signal Co., Ltd. (71,141).—Capital, £425,000 in £1 shares (220,000 pref. and 205,000 ord.); return dated December 9th, 1913; 214,195 pref. and 150,548 ord. shares taken up; £1 per share called up on 24,999 pref. and 27,840 ord.; £52,839 paid; £311,904 considered as paid on 189,196 pref. and 122,708 ord. Mortgages and charges: Nil.

Feld Bros. & Co., Ltd. (105,577).—Capital, £5,000 in £1 shares; return dated October 7th, 1913; 1,402 shares taken up, £402 paid; £1,000 considered as paid. Mortgages and charges; Nil.

Dick, Kerr & Co., Ltd. (63,407).—Capital, £650,000 in £1 shares (350,000 pref.). Return dated October 23rd, 1913. 305,000 pref. and 260,000 ord. shares taken up. £565,000 considered as paid. (Previous returns have erroneously stated £265,000 paid on pref., and £300,000 considered paid on ord.). Mortgages and charges: £241,060.

Frederick Braby & Co., Ltd. (2,537C).—Capital, £400,000 in 37,500 ord. and 2,500 pref. shares of £10 each. Return dated September 2nd, 1913 (filed November 25th). 27,500 ord. and 2,500 pref. shares taken up. £10 per share called up on 16,750 ord., £6 on 3,250 ord., £1 on 7,500 ord., and £10 on 2,500 pref. £219,520 paid, including £20 on five shares forfeited. £13,000 (£4 per share) considered as paid on 3,250 ord. Mortgages and charges: £55,000.

Amazon Telegraph Co., Ltd. (44,532).—Capital, £250,000 in £10 shares. Return dated December 2nd, 1913. All shares taken up. £250,000 paid. Mortgages and charges: £287,100.

CITY NOTES.

Argentine Tramways and Power Co.

MR. W SANDFORD POOLE presided on Tuesday at the offices, 62, London Wall, over the first annual meeting of the above company. The proceedings were purely formal, and the following report to September 30th, 1913, was adopted:—"The horse tramways and the concession for the construction and operation of electric tramways and an electric lighting and power system in Santa Fé have been transferred to the company. A site for the power house and car-sheds has also been acquired. Under the construction contract with Messrs. J. G. White & Co., Ltd., the work of converting the horse tramways owned by the company to electric traction is progressing satisfactorily, and the first section, some 8 miles of track, is expected to be ready for service in March next. Arrangements for constructing the remaining sections and the lighting system are also in the hands of Messrs. J. G. White & Co., Ltd., and are being pressed forward. The directors report, with very great regret, the death on September 30th last of Mr. T. Frame Thomson, their chairman. Mr. W. Sandford Poole has been elected to fill the vacancy thereby created, and has been appointed chairman."

German Electrical Companies.

The report of the Siemens-Schuckert Works Co. for 1912-13 states that a slackening of the brisk demand occurred in the spring as a result of the diminution in the spirit of enterprise in Germany and abroad in consequence of the political disquietude. This state of affairs also continued into the new financial year, but a change for the better had now to be recorded. The working results for the year were satisfactory. The capacity of the works had been considerably increased by the extensions carried out in the preceding year, thereby providing for a new period of advancement. During the year the company's German works delivered 132,800 generators, motors and transformers of a total of 4,064,228 H.P., as compared with 134,539 and 3,737,674 H.P. in 1911-12. The period of development of the industry was naturally connected with that of the general national economy. But independently of this circumstance the formation of an opinion of the future was supported by the fact that the supply of electrical energy had frequently only been carried out in an incomplete manner and in part still required to be undertaken. The company had received an order for the electrical equipment of a trial train in connection with the experiments to be made on the Berlin City and Circle railways, and a large number of locomotives for main lines were under construction in the shops. Orders were also obtained for the Berlin Electric and Underground railway and the Hamburg railway, together with numerous contracts for tramways and for railways for ironworks and mines, and greater activity also took place in electric drives and equipments for industries. It is further mentioned that a large expansion occurred in the export trade.

The report of the directors of the Siemens & Halske Co. for 1912-13 states that the ascending line which the course of business assumed in preceding years continued in all branches in the past year. The results obtained by the Siemens-Schuckert Works, in which the company is a joint partner with the Electricity Co. (late Schuckert), of Nuremberg, and which represents an amalgamation of the heavy electrical engineering departments for the purpose of excluding mutual competition, also turned out satisfactorily. The number of officials and workers employed by the company at the Siemens-Schuckert Works rose from 70,000 in 1911-12 to 81,235 last year, but the effect of this increase was substantially surpassed by the fresh augmentation in the turnover. It was now over ten years since the rearrangement of the entire undertaking was initiated which led to the formation of independent companies for the heavy branches, and the system had been of advantage to the development of both spheres of activity as they mutually obtained greater liberty for advancement. Whilst the expansion of the light and heavy departments first took place in Germany and was soon followed in Austria-Hungary and England, the same practice had now been brought into operation in Russia. The company always had in view the question that the requisite funds should be able to be placed at its disposal to provide for further sound development and the extension of the manufacturing activity, but a limitation had been set to the investment of capital in electrical undertakings, etc.

During the past few years a considerable extension had taken place in the light electrical branches and in many departments there had been an unforeseen development. The introduction of automatic and semi-automatic telephone exchanges was making good progress, and in all cases the installations had well withstood the test. Orders for interurban telephone cables for abroad were also on hand, and the high speed telegraph apparatus enjoyed growing popularity with home and foreign telegraph administrations. A number of novelties in instruments and electro-medical appliances had been placed on the market. The employment of electric power for the movement of points and signals was still increasing. Concerning the glow lamp factory the report remarks that a considerably greater production took place in the year, and the manufacture of a new wire lamp, brought out by the United States General Electric Co. was begun on the basis of the agreement existing with that company in regard to the interchange of patents for metallic filament lamps. The efforts put forth to obtain increased lighting per unit of energy had led to noteworthy progress also in the case of arc lamps, and the flame carbons made in various grades by Siemens Brothers & Co. had largely contributed towards this result. The extensions made during the year in the network of the Berlin Electric and Underground railway had provided good employment for the railway department, and the company had also received a large constructional order for the municipal railway between the North and the South of Berlin. It is added that the working of the elevated railway in Hamburg developed satisfactorily so that large repeat orders were secured.

French Electrical Companies.

The amalgamated undertaking of the supply companies in Paris—the Compagnie de Distribution d'Electricité—will replace the Union des Secteurs, in January. The company, which has an ordinary share capital of £4,000,000, now proposes to make an issue of £1,000,000 in the form of 5 per cent. bonds. The commission will increase the total loan capital to £4,000,000, as there are already in circulation bonds for £2,000,000 of the 3½ per cent. class and £1,000,000 of the 4 per cent. type.

The Electricité de Paris earned gross profits of £268,000 in 1912-13 on an ordinary share capital of £1,000,000, this comparing with £222,000 in the preceding year. As net profits the accounts show the sum of £101,000 as against £92,000 in 1911-12. It has been decided to distribute 16/- per share on the 100,000 shares of £10 nominal, this rate contrasting with 14/4½ per share in the previous year. The loan capital amounts to £947,000, whilst the securities in portfolio represent the value of £672,000.

The Compagnie Générale d'Electricité of Paris, whose share capital was increased from £720,000 to £1,000,000 last January, records gross profits of £191,000 in 1912-13 as against £144,000 in the preceding year; and net profits of £146,000 as compared with £104,000. In addition an extraordinary profit of approximately £40,000 was realised from the sale of shares held in the Energie Electrique de Catalogue, which amount has been placed to the reserve fund, thus raising the latter to £1,064,000 as contrasted with £626,000 in 1911-12. The dividend is at the rate of £2 per share as against £1 12s. in the previous year. The loan debt now totals £984,000, or £20,000 less than in 1911-12.

The Société d'Electro-Métallurgie of Dives, which has an ordinary share capital of £800,000, reports net profits of £59,000 for 1912-13 as compared with £28,000 in the previous year. The latter, however, only comprised a period of six months, whilst production in 1912-13 was prejudiced for a time through an outbreak of fire at the works. It is proposed to pay a dividend of 5 per cent. on 40,000 shares, this contrasting with the same rate on 30,000 shares in the preceding year. Excepting a sum of £6,000 the insurance companies have reimbursed the company for the damages caused by the fire. The directors, however, protest against the custom of the insurance companies in making deductions for the depreciation of the insured plant, seeing that the company has paid the full amount of the premiums for years past.

Russian Siemens-Schuckert Works.—As legal sanction has now been given to the alteration in the name of the Russian Schuckert Co. to that of the Russian Siemens-Schuckert Works, and to the increase in the share capital from £300.000 to £1,500,000, the Russian Siemens & Halske Co. is transferring the whole of its heavy electrical engineering departments to the Siemens-Schuckert Co., in which the company remains financially interested. On the other hand, the Siemens & Halske Co. will continue the light electrical branches, including railway safety appliances and signalling and wireless telephony and telegraphy, which are to be developed by the devotion of the whole of the works in St. Petersburg to these branches. It is also proposed to make comprehensive extensions of the works taken over by the Siemens-Schuckert Co., particularly the dynamo works and the works for material for the Army and the Navy, which will be completed in the current financial year.

Spain.—A company has just been formed in Brussels, with a capital of £60,000 and the title La Société des Tramways Electriques d'Alicante, to acquire and carry on certain electric tramways in Spain.

Japan.—The report of the Tokio Electric Light Co. for the last financial half-year, shows a net profit of £190,804, increased by the amount brought forward to £235,829. A dividend of 10 per cent. is being declared.

During November last a sum of £60,500 was invested in the electrical industry in Japan, £10,000 being in respect of new enterprises, and £50,500 for the extension of old concerns.

Bell Telephone Co. of Canada.—The directors have declared a dividend of 2 per cent., payable on January 15th.—*Financier.*

Paris Compressed Air Co.—The accounts of the Compagnie Parisienne de l'Air Comprimé (Secteur Popp), whose direct interest in the supply of electricity expired with the close of 1913 when the Union des Secteurs was replaced by the Compagnie de Distribution d'Electricité, show net profits of £207,000 for 1912-13 on a share capital of £1,000.000, as contrasted with £137.000 in the preceding year. It has been decided to pay a dividend of £1 16s. per share on the ordinary capital, this being the same rate as in 1911-12, and to allocate £80,000 to the special reserve fund. The company, whose electricity supply business yielded nearly four times the gross profits realised from the compressed air branch in 1912-13, remains indirectly interested in the lighting of Paris through its shareholding in the Compagnie de Distribution, whilst the compressed air concession will not lapse before 1927.

Consolidated Diesel Engine Manufacturers, Ltd.—The Shareholders' Committee has asked the board to call a meeting for January 14th to consider its report on investigation of the company's affairs.

Clevedon, Portishead and District Electric Supply Co., Ltd.—The first ordinary general meeting of this company was held on December 18th. The chairman explained that the meeting was necessary in order to comply with the Board of Trade Regulations, and moved the adjournment until some time in February. This was carried. Mr. F. Christy stated that the supply of current was available on August 19th, and the company commenced with three customers, whereas there were now 54 consumers, in addition to the public lighting throughout the district, which was giving every satisfaction. Many electric kettles, domestic irons and radiators were in use, and the progress made during the period was eminently satisfactory. It was anticipated there would be quite a decent balance of profit to carry forward when the accounts were made up. Mr. Christy also stated that it was hoped that the Clevedon district would have the opportunity of taking the light towards the end of the coming year.

India.—The Ahmedabad Electricity Co., Ltd., held its first statutory general meeting in November at Bombay, Sir H. E. E. Proctor presiding. The report stated that the licence granted by the Bombay Government, under the Indian Electricity Act, to Killick, Nixon & Co., was now vested in the company. The agreement between the company and the Ahmedabad Municipality providing for the supply to the latter of a minimum of 30,000 units per annum had been duly executed. Building operations for the generating station were to commence on December 1st, and the first unit of plant was expected to arrive next May. They regretted that they had been unable to obtain earlier delivery. The supply was not likely to be available until September. In the absence of Mr. T. O. Callender, Mr. W. Roberts, of Callender's Co., was asked to join the board. The chairman, in moving the adoption of the report to October 31st, said that the delay in giving supply was quite unavoidable owing to the impossibility of obtaining early delivery of the Diesel engines, the demand for which was very great indeed. The prospectus specified a low-tension D.C. system of distribution, but, acting on expert advice, they were changing their minds and adopting A.C.—3,300-volt three-phase transformed down to 400-volt three-phase four-wire for general purposes. This would lend itself to more ready expansion. They were also slightly increasing the initial capacity of one of the generating sets, involving an extra cost of £550, but they would reduce the cost per KW. They had received many inquiries for current, and did not anticipate any difficulty in disposing of the output estimated in the prospectus.

The Hon. Sir Jamsetji Jejibhoy seconded, and the report was adopted.

Stock Exchange Notices.—Applications have been made to the Committee to allow the following to be quoted in the Official List :—

American Telephone and Telegraph Co.—$29,077,800 additional convertible 4½ per cent. gold bonds.

Rangoon Electric Tramway and Supply Co., Ltd.—Scrip £48 per cent. paid for £100,000 5 per cent. mortgage debenture stock.

The Committee has ordered the undermentioned to be quoted in the Official List :—

London Electric Railway Co.—36,357 ordinary shares of £10 each, fully paid, Nos. 1 to 36,357.

Underground Electric Railways Co. of London, Ltd.—Further issue of £76,000 4½ per cent. bonds of 1933 of £100 each, Nos. 16,688 to 17,447.

STOCKS AND SHARES.

Tuesday Evening.

CONVENTION and custom immemorial demand that some sort of review of the preceding twelvemonth should be made on New Year's Eve. Times there are when this is far from a pleasant business, and this is one of those instances. The year just closing has been a very bad one for the Stock Exchange, for reasons familar to everybody interested in stocks and shares, and which have been duly chronicled from time to time in these columns. How bad it has been, a glance at the following tables helps to show. Amongst the welcome surprises, however, may be noted the steadiness of London's electricity supply shares, variations in which have been comparatively few throughout the period. In order to make a good start, we will first take this particular market, showing the net fluctuations this year. Here is our catalogue of ordinary shares in most of the leading companies :—

	Dec. 31st, 1912.	Dec. 30th, 1913.	Rise or fall.
Brompton and Kensington	9	8⅞	— ⅛
Charing Cross	4⅞	4⅝	— ⅛
Chelsea	4¼	4⅞	+ ⅝
City of London	17	17	—
County of London	12⅜	12	— ⅜
Kensington and Knightsbridge	7⅞	7⅞	—
London Electric	1⅛	1⅛	—
Metropolitan	8⅜	8⅜	—
Notting Hill (Preference)	10¼	10¼	—
St. James's and Pall Mall	10	8⅞	— 1⅛
South London	8¼	9 1/16	— 1/16
South Metropolitan (Preference)	1 15/16	1 13/16	— 1/16
Westminster	9	8½	— ½

All the railway markets in the Stock Exchange have suffered from one cause or another, and Home Rails have been particularly affected by labour troubles dear money, and competition from other investment sources. The principal feature is the heavy fall in Central London non-assenting issues, as may be seen from the following short table of stocks and shares, which embraces representative examples of electrical traction descriptions :—

	Dec. 31st, 1912.	Dec. 30th, 1913.	Rise or fall.
British Elec. Trac. Pref.	12½	12½	—
Central London, Deferred	83	63½	— 20½
,, ,, Assented	—	79	—
London United Trams, Deb.	70½	59	— 11½
Metropolitan Railway Consol.	53½	45⅝	— 7⅞
Metropolitan District	40⅜	32	— 8⅜
Underground Elec. £10 Shares	4⅛	3⅛	— 1
,, Income Debs.	93½	89	— 4½

Brazil, Mexico and Canada have proved positive sieves for the loss of British capital during 1913. Brazil has been perturbed by the heavy fall in rubber and coffee, Canada by the scarcity of hard cash, coming on the top of over-trading in previous years, and Mexico, of course, by the revolution. It is a melancholy story which holders of securities in these three countries have to con this year, and the next examples give some idea of the slump which has taken place in the various kinds of issues :—

	Dec. 31st, 1912.	Dec. 30th, 1913.	Rise or fall.
Brazilian Traction, Ord.	94¼	84	— 10¼
Canadian Gen. Elec., Com.	115	106	— 8½
Mexican Light and Power, Com.	85	42	— 43
do. First Mort.	96	79	— 17
Mexico Trams, Com.	112	66½	— 44½
do. 6 per cent. Bonds	104	81½	— 21½
Monterey, First Deb.	87½	60½	— 27
Shawinigan Water	145	135	— 10
Rio de Janeiro Trams, First	103	100½	— 2½
Sao Paulo Trams, First	103	98½	— 4½

Foreign Tramway varieties have been fairly steady on the whole, with the exception of British Columbia Electric stocks. There has been a drop of 34 points in the Deferred, due, principally, to sympathy with the flatness of Canadian investments. We give a quintet of instances to show the rise or fall on the year :—

	Dec. 31st, 1912.	Dec. 30th, 1913.	Rise or fall.
Anglo-Argentine Trams 1st Pref.	4⅞	4 13/16	— 1/16
British Columbia Electric Deferred	141	107	— 34
Calcutta Trams Ordinary	5⅞	6¼	+ ⅜
Para Electric Railways Ordinary	7½	5⅞	— 1⅝
United Electric Tram, Monte Video	5¾	4⅝	— 1⅛

Stocks and shares in the Telegraph and Telephone market have gone softly. American Telephone and Telegraph stock, after being 142, fell to 115; this was the heaviest decline during the year, but there has been a recovery from the worst. The excitement in Marconis has been spasmodic, and the market has fallen upon quiet days, the drop on balance amounting to 28s. 9d. The examples which follow are representative of the various classes of companies concerned with this industry :—

	Dec. 31st, 1912.	Dec. 30th, 1913.	Rise or fall.
American Telegraph and Telephone	142	125½	— 16½
Anglo-American Preferred	111½	105⅝	— 5⅞
Direct United States	7⅛	6⅝	— ½
Eastern	134½	125⅝	— 9
Eastern Extension	13⅛	12⅛	— 1
Globe Telegraph and Trust	10⅝	10⅞	+ ¼
Great Northern	28½	31½	+ 3
Indo-European	57	58	+ 1
Marconi's Wireless	4⅜	3 5/16	— 1 1/16
Oriental Telephone	13⅜	14⅜	+ 3/16
Reuters	10½	9	— 1½
United River Plate Telephone	7 1/16	6⅝	— 7/16
West India and Panama	3⅛	2⅝	— ½
Western Telegraph	13½	12⅞	— ⅝

It remains only to add a selection from the Manufacturing group, an outstanding feature of which is a substantial recovery in the price of Crompton Debenture stock. It is said in the Stock Exchange that the electrical manufacturing companies are doing much better than they were a year ago, but as to this the readers of these notes are probably in a position far better for judging accurately than the writer of them. The movements, it will be observed, show a preponderance of rises over declines :—

	Dec. 31st, 1912.	Dec. 30th, 1913.	Rise or fall.
Babcock & Wilcox	3 3/16	2⅞	— 5/16
British Aluminium	¾	1 1/16	+ 5/16
British Insulated	7¾	8	+ ¼
Brush Second Deb.	30	25	— 5
Callender's Cable	10⅞	10⅞	—
Castner-Kellner	3½	3½	—
Crompton Deb.	61	70⅜	+ 9⅜
Dick, Kerr & Co.	1/16	1/16	—
Edison & Swan First Deb.	66	59	— 7
Henley's	12⅜	13⅛	+ ¾
India-Rubber	10	12	+ 2
Telegraph Construction	35½	38	+ 2½

Remains there nothing further to add than the sincere wish that to all of those who are interested in electrical investments and businesses, the New Year may prove one of bountiful prosperity and sustained success.

Northern General Transport Co.—According to a financial daily, this company has been formed with the object (among others) of carrying on in the Northern Counties, transport business in all its branches, and especially with a view to consolidating the interests of the shareholders of the Gateshead and District Tramways Co., the Tynemouth and District Electric Traction Co., Ltd., and the Jarrow and District Electric Traction Co., Ltd.

SHARE LIST OF ELECTRICAL COMPANIES.

ELECTRIC RAILWAYS AND TRAMWAYS.—HOME.

NAME.	Stock or Share.	Dividends for 1912.	Dividends for 1913.	Closing Quotations Dec. 30th.	Rise + or Fall —	Present Yield p.c. £ s. d.
Bath Trams, Pref. Ord.	* 1	Nil	..	3/16 — 5/16	..	Nil
Do. 5 % Pref.	1	5	5	9/16 — 11/16	..	6 8 0
Do. 4½ % Deb.	100	4½	4½	70 — 75	..	6 0 0
Brit. Elec. Trac., 6 % Pref.	100	..	..	11½ — 13½	+1	..
Do. Do. Deferred	100	..	..	4½ — 6	+ ½	..
Do. Do. 6 % Cum. Pr'f.	100	6	6	85 — 88	+1	6 16 4
Do. 7 % Non-Cum. Pr'f.	100	8	..	52 — 55	..	5 9 1
Do. 5 % Perp. Deb.	100	5	5	92 — 95	..	5 5 5
Do. 4½ % 2nd Deb.	100	4½	4½	77 — 80	..	5 12 6
Central London Railway, Ord.	100	8	8	61 — 66	..	4 11 0
Do. Gtd. Assented	100	..	4	82 — 84	..	4 15 3
Do. Pref.	100	4	4	70 — 75	..	5 6 8
Do. Gtd. Assented	100	..	4	82 — 84	..	4 15 3
Do. Def.	100	2	..	60 — 65	..	3 1 7
Do. Gtd. Assented	100	..	4	78 — 80	..	5 0 0
Do. 4 % Deb.	100	4	4	97 — 99	..	4 0 10
City & S. London, 5 % Pref., 1891	100	5	5	96 — 98	..	5 2 0
Do. Do. 1896	100	5	5	96 — 98	..	5 2 0
Do. Do. 1901	100	5	5	95 — 97	..	5 3 1
Do. Do. 1903	100	5	5	94 — 96	..	5 4 2
Do. 4 % Deb.	100	4	4	89 — 91	..	4 8 0
Hastings Trams, 6 % Pref.	1	6	6†	½ — ¾	..	8 0 0
Do. 4½ % Deb.	100	4½	4½	66 — 71	..	6 6 9
Isle of Thanet Trams, 5 % Pref.	5	2½	3	2 — 2½ xd	..	6 13 4
Do. 4 % Deb.	100	4	4	71 — 76 xd	..	5 5 3
Lancashire United, 5 % Deb.	100	5	5	76 — 79 xd	..	6 6 7
London and Suburban, Ord.	1	..	..	7/32 — 11/32	+ 1/32	..
Do. Do. 5 % Cum. Pref.	1	..	5†	9/16 — 11/16	+ 1/16	..
Do. Do. 4½ % 1st Deb.	100	4½	4½	72 — 77 xd	..	5 17 0

NAME.	Stock or Share.	Dividends for 1912.	Dividends for 1913.	Closing Quotations Dec. 30th.	Rise + or Fall —	Present Yield p.c. £ s. d.
London Elec. Railways, 4 % Deb.	* 100	4	4	90 — 92	..	4 7 0
London United Trams, 4 % Deb.	100	4	4	57 — 61 xd	..	6 11 2
Metropolitan Railway Consol.	100	1⅜	1⅜†	45½ — 46	+2½	3 10 8
Do. Surplus Lands	100	2¾	2¾†	58 — 60	..	4 11 8
Do. 3½ % Deb.	100	3½	3½	83 — 85	..	4 2 4
Do. 3½ % Pref.	100	3½	3½	78 — 80	..	4 7 6
Do. 3½ % Con. Pref.	100	3½	3½	75 — 77	..	4 11 0
Metropolitan District Ord.	100	Nil	..	3 3/8 — 3 5/8	+1/2	Nil
Do. 6 % Deb.	100	6	6	133 — 136 xd	..	4 8 3
Do. 4 % Deb.	100	4	4	90 — 92 xd	..	4 7 0
Do. 4 % Prior Lien	100	4	4	94 — 96	+1	4 3 4
Do. 4½ % First Pref.	100	4½	4½	81 — 83	..	5 8 5
Do. 3½ % Gtd.	100	3½	3½	74 — 76	..	4 12 1
Metro. Elec. Trams, 4½ % Deb.	100	4½	4½	80 — 84 xd	..	5 7 2
Do. 5 % Deb.	100	5	5	86 — 89	..	5 12 0
Potteries, Ord.	1	3½	..	5/16 — 7/16	..	..
Do. 5 % Pref.	1	5	5	5/16 — 7/16	..	7 5 6
Do. 4½ % Deb.	100	4½	4½	84 — 87	..	5 3 6
South Metro. Trams, 6 % Pref.	1	6	6†	3/8 — 5/8	..	8 0 0
Do. 4 % Deb.	100	4	4	66 — 70 xd	..	5 14 4
Underground Elec. Railways	10	..	..	3½ — 3¾	..	Nil
Do. "A"	1/-	..	..	3/8 — 7/16	..	Nil
Do. 6 % First Cum. Inc. Deb.	100	6	6	111 — 113	..	5 6 2
Do. 4½ % Bonds	100	4½	4½	99 — 101	..	4 9 1
Do. 6 % Income	100	6	6	88½ — 89½	+ ½	6 14 10
Yorkshire (West Riding), Ord.	5	Nil	..	1/16 — 3/16	..	Nil
Do. 6 % Pref.	5	3	4	3½ — 4	..	5 0 0
Do. 4½ % Deb.	100	4½	4½	80 — 85 xd	..	5 6 0

ELECTRIC RAILWAYS AND TRAMWAYS.—COLONIAL AND FOREIGN.

Anglo-Arg. Trams, 1st Pref.	5	5½	5½	4 11/16 — 4 15/16 xd	+ ⅛	5 11 4
Do. 2nd Pref.	5	5½	5½	4 3/8 — 4 7/8 xd	+ ⅛	6 3 11
Do. 4 % Deb.	100	4	4	88 — 90 xd	..	4 9 0
Do. 4½ % Deb.	100	4½	4½	94 — 98 xd	..	4 11 10
Do. 5 % Deb.	100	5	5	97½ — 99½	+ ½	5 0 6
Auckland Trams, 5 % Deb.	100	5	5	100 — 102 xd	..	4 18 0
Bombay Elec. S. & Trams, Pref.	10	6	6	10⅜ — 11½	..	5 4 4
Do. 4½ % Deb.	100	4½	4½	92 — 94 xd	..	4 15 9
Do. 5 % 2nd Deb.	100	5	5	97 — 100	..	5 0 0
Brazilian Traction, Light and Power	$100	6	6†	83 — 85	—1½	7 1 2
Brisbane Trams Invt., Ord.	5	8	8	7½ — 7¾	..	5 3 3
Do. 5 % Pref.	5	5	5	4 7/8 — 5 1/8	..	4 13 0
Do. 4½ % Deb.	100	4½	4½	96 — 99 xd	..	4 11 0
B. Columbia Elec. Rly., Def.	100	8	8†	105 —109 xd	..	7 6 10
Do. Pref. Ord.	100	6	6	102 —106	..	5 13 2
Do. 5 % Pref.	100	5	5	102 —105	..	4 15 3
Do. 4½ % 1st Mort. Deb.	40	4½	4½	98 —101	..	4 9 1
Do. 4½ % Vancouver Deb.	100	4½	4½	100 —104	..	4 6 7
Do. 4½ % Con. Deb.	100	4½	4½	92 — 95	..	4 9 6
Calcutta Trams, Ord.	5	7½	5†	6 — 6¼	+ ⅛	5 15 5
Do. 5 % Pref.	5	5	5	4 7/8 — 5 1/8 xd	..	4 17 7
Do. 4½ % Deb.	100	4½	4½	93 — 96 xd	..	4 13 9
Cape Electric Trams	1	5	5	2 1/16 — 2 3/16	..	6 19 0
City Buenos Aires Trams (1904)	5	5†	5	5 1/16 — 5 3/16	..	4 10 11
Do. 4 % Deb.	100	4	4	91 — 96 xd	..	4 3 4
Colombo Elec. Tr. & Lt., 5 % Deb.	100	5	5	88 — 92	..	5 8 8
Havana Elec. Rly., 5 % Bonds	$1000	5	5	94½ — 98½	..	5 1 6
Kalgoorlie Elec. Trams	1	Nil	..	0 — 1/16	..	Nil
Do. 5 % A Deb.	100	5	5	85 — 90 xd	..	5 11 1
Do. 6 % B Deb.	100	3	..	10 — 20	..	Nil

La Plata Elec. Trams, Ord.	1	..	..	3/8 — 1/2	..	..
Do. Pref.	1	4½d.	6	3/4 — 1	..	6 0 0
Lisbon Elec. Trams, Ord.	1	6	6†	1⅛ — 1⅜	..	4 7 3
Do. 6 % Pref.	1	6	6	1 1/16 — 1 1/8 xd	..	5 1 0
Do. 5 % Deb.	100	5	5	91 —96	..	5 4 2
Madras Elec. Tr., 6 % Cum. Pref.	5	6	6	4¾ — 5¼	..	5 14 3
" Elec. Tr. (1904), Deb.	100	5	5	99 —101 xd	..	4 19 0
Manaos Trams & Lt., 1st Deb.	100	5	5	81 — 84	..	5 19 1
Manila Elec. R. and Ltg., Bonds	$1000	5	5	96½ — 98½	..	5 1 6
Mexico Trams Com	$100	7	7	65 — 68	—6	10 5 10
Do. Gen. Con. 5 % Bonds	..	5	5	77 — 82	..	6 2 0
Do. 6 % Bonds	100	6	6	80 — 83	+2	7 4 7
Para Elec. Hlys. & Lt., Ord.	5	10	10†	5½ — 6	— ⅛	8 6 8
Do. 6 % Pref.	5	6	6	4½ — 5	— ⅛	6 0 0
Do. 5 % 1st Deb.	100	5	5	94¾ — 96½	..	5 3 8
Perth (W.A.) Elec. Tr., Ord.	1	5½	..	1⅛ — 1⅜	..	4 0 0
Rangoon El. Tr. & Sup., Pref.	5	6	6	5½ — 5⅝	..	5 6 8
Do. 4½ % 1st Deb.	100	4½	4½	96½ — 98½	..	4 11 5
Rio de Janeiro Trams, 1st Mort. 5 % Bonds	..	5	5	99½ — 101½	..	4 18 6
Do. 5 % Mort. Bonds	100	5	5	90 — 92	..	5 8 9
Sao Paulo Tram., Lt. and P. 5 % 1st Deb.	$500	5	5	97 —100	..	5 0 0
Singapore Trams, 5 % Deb.	100	5	5	86 — 90	..	5 11 1
Southern El. Tr. B.A., 5 % Deb.	100	5	5	98 — 95	..	5 5 8
Un. Elec. Trams Monte Video	5	7	7	4⅜ — 4¾	— ⅛	7 3 7
Do. 6 % Pref.	5	6	6	4⅜ — 5⅛	..	5 17 1
Do. 5 % 1st Deb.	100	5	5	99½ — 99½	..	5 3 8
Winnipeg Elec. Rly., 4½ % Deb.	100	4½	4½	95 — 97	..	4 12 9

ELECTRICITY SUPPLY AND POWER COMPANIES.—HOME.

Bournemouth & Poole, Ord.	* 10	4½	4½	9 — 10	— ½	6 0 0
Do. 4½ % Pref.	10	6	6	10 — 10½	..	5 14 3
Do. Second 6 % Pref.	Stock	4½	4½	93 — 96 xd	..	4 13 9
Do. 4½ % Deb. Stock	5	10	9†	8⅝ — 9⅛	..	4 9 9
Brompton & Kensington, Ord.	5	7	7	8¼ — 8⅝	..	4 0 0
Do. 7 % Cum. Pref.	100	4	4	90 — 93	..	4 6 0
Central Electric Supply, 4 % Guar. Deb.	5	5	5†	4⅛ — 5	..	5 0 0
Charing Cross, West End & City	5	4½	4½	4 — 4½	..	5 0 0
Do. 4½ % Cum. Pref.						
Do. "City Undertaking" 4½ % Cum. Pref.	5	4½	4½	3½ — 4 xd	..	5 12 6
	100	4	4	89 — 91 xd	..	4 8 0
Do. Do. 4 % Deb.	5	5	4†	4⅝ — 6⅛	..	4 17 7
Chelsea, Ord.	Stock	4½	4½	94 — 97 xd	..	4 12 9
Do. 4½ % Deb.	10	9	6†	16½ — 17½	..	5 2 10
City of London, Ord.	10	6	6	13 — 14	..	4 5 9
Do. 6 % Cum. Pref.	Stock	5	5	114 — 118 xd	..	4 4 9
Do. 5 % Deb.	100	4½	4½	97 — 99 xd	..	4 11 0
Do. 4½ % Second Deb.	10	6	5†	11⅜ — 12½	..	4 18 0
County of London, Ord.	10	6	6	11⅜ — 12	..	5 0 0
Do. 6 % Pref.	Stock	4½	4½	101 —103 xd	..	4 7 5
Do. 4½ % Deb.	Stock	4½	4½	98 — 101	..	4 9 1
Do. 4½ % Second Deb.	£8	..	..	5/8 — 3/4	..	Nil
Edmundson's, Ord.	5	6	6	3⅞ — 4⅛	..	7 1 2
Do. 6 % Cum. Pref.	5	..	..	1⅜ — 1⅝	..	..
Do. 6 % Non-Cum. Pref.	100	4½	4½	80 — 83	..	5 8 5
Do. 4½ % First Mort. Deb.	5	6	6	4⅜ — 4⅞	..	6 3 1
Folkestone	5	5	5	4⅜ — 4⅞	..	5 2 7
Do. 5 % Cum. Pref.	100	4½	4½	89 — 91	..	4 19 0
Do. 4½ % First Deb.	5	9	8†	8½ — 9¼	..	4 17 9

Hove	10	6	5†	9⅛ — 10⅛	..	5 17 1
Kensington & Knightsbridge, Ord.	5	8	8†	7⅜ — 8⅛	..	4 17 6
Do 4 % Deb.	Stock	4	4	90 — 92	..	4 7 0
Kent Elec. Power, 4½ % Deb.	Stock	4½	4½	76 — 80	..	5 12 6
London Electric, Ord.	3	2½	..	1⅜ — 1⅝	..	4 12 7
Do. 6 % Pref.	5	6	6	4⅝ — 5⅛	..	5 14 8
Do. 4 % First Mort. Deb.	Stock	4	4	90 — 93	..	4 6 3
Metropolitan	5	4	4†	3⅛ — 3⅜	+ ⅛	5 6 8
Do. 4½ % Cum. Pref.	5	4½	4½	4⅜ — 4⅝	..	4 14 9
Do. 4½ % First Mort. Deb.	Stock	4½	4½	95 — 98 xd	..	4 11 10
Do. 3½ % Mort Deb.	Stock	3½	3½	77 — 81 xd	..	4 6 5
North Metropolitan Power Supply, 5 % Mortgages (Red.)	100	5	5	100 - 103	..	4 17 1
Notting Hill, 6 % Non-Cum. Pref.	10	6	6	9⅜ — 10⅞ xd	..	5 14 3
Oxford	5	7	6†	6 — 6½	..	5 7 8
St. James' and Pall Mall, Ord.	5	10	10†	8½ — 9	..	5 11 1
Do. 7 % Pref	5	7	7	6⅝ — 7⅛	+ ⅛	4 18 3
Do. 3½ % Deb.	100	3½	3½	81 — 84 xd	..	4 3 4
South London, Ord.	4	5½	..	2⅞ — 3⅛	..	6 15 4
Do. 5 % First Mort. Deb.	100	5	5	96 — 99 xd	..	5 1 0
South Metropolitan, 7 % Pref.	1	7	7	1 3/8 — 1 7/8	..	5 14 9
Do. 4½ % First Deb. Stock	100	4½	4½	93 — 96	..	4 13 9
Urban, Ord.	£3	Nil	..	1/16 — 3/16	..	..
Do. 5 % Cum Pref.	5†	3	..	2⅛ — 2⅞	..	..
Do. 4½ % First Mort. Deb.	100	4½	4½	83 — 86	..	5 4 8
Westminster, Ord.	5	10	10†	8½ — 8¾	..	5 14 3
Do. 4½ % Cum Pref.	5	4½	4½	4 13/16 — 5 1/16	..	4 6 10

* Unless otherwise stated, all shares are fully paid. † Interim Dividend. ‡ 3s. in Funded Dividend Certs.

Continued on next page.

SHARE LIST OF ELECTRICAL COMPANIES.—*(Continued.)*

ELECTRICITY SUPPLY AND POWER—COLONIAL AND FOREIGN.

NAME.	Stock or Share.	Dividends for		Closing Quotations Dec. 30th.	Rise + or Fall —	Present Yield p.c.
Adelaide, 6 % Pref.	£	6	6†	5⅛ — 5⅝	..	5 11 7
Calcutta, Ord.	£	6½	6†	7⅛ — 7⅜	..	5 11 6
Do. 5 % Pref.	£	5	5	4⅝ — 5⅛	..	4 17 7
Calgary Power, 1st Mort. Bds.	100	5	5	91 — 93	..	5 7 6
Canadian Gen. El. Com.	$100	7	8	104 — 109 xd	..	7 6 10
Do. 7 % Pref.	$100	7	7	119 —124	..	6 12 11
Cordoba Lt., Power and T., Ord.	£	5	..	⅞ — ⅞	..	7 13 0
Do. 5 % Deb.	100	5	5	91 — 93	..	5 7 6
Elec. Lt. and P. of Cochabamba, 6 % Bonds	100	6	6	88½ — 90½	..	6 12 7
Elec. Supply Victoria, 6 % 1st Mort. Deb.	100	5	5	91 — 94 xd	..	5 6 5
Elec. Dev. Ontario, 5 % 1st Mort. Bonds	$500	5	5	94½ — 96½	..	5 8 8
Kalgoorlie Elec. P. and L., Ord.	10/-	Nil	..	7/16 — 8/16	..	Nil
Do. 6 % Pref.	£	6	6†	11/16 — 12/16	..	11 5 8
Kaministiquia Power, 5 % G. Bs.	$500	5	5	103½ —104½	..	4 15 8
Madras, Ord.	£	Nil	..	1½ — 1⅝	..	..
Melbourne, 5 % 1st Mort. Deb.	100	5	5	101 —104 xd	..	4 16 0
Mexican El. Lt., 5 % 1st M. Bds.	..	5	5	68 — 73	..	7 0 10
Mexican Lt. & Power, Common	$100	4	4	40 — 44	—3	9 1 10
Do. 7 % Cum. Pref.	$100	7	7	74 — 79	—4	8 17 2
Do. 5 % 1st Mort. Gold Bds.	..	5	5	77 — 81	..	6 3 5
Do. 6 % 2nd Mort. Bonds	100	5	5	66 — 71	..	7 0 10
Monterey Rly., Light & Power, 5 % 1st Mort. Deb.	* 100	1912. 5	1913. 5	58 — 63	..	£ s. d. 7 16 6
Montreal, Lt., H. and Power	$100	9	10†	216 —222	..	4 10 1
Northern, Lt., Power and Coal, 5 % 1st Mort. Bonds	$500	5a	5a	10 — 20	..	..
River Plate, Ord.	Stock	10	..	207 —217	..	4 8 0
Do. 6 % Non-Cum. Pref.	Do.	6	6	101 —106	..	5 13 2
Do. 5 % Deb. Stock	Do.	5	5	93 —100 xd	..	5 0 0
Roy. Elec. Co., Montreal, 4½ % 1st Mort. Deb.	100	4½	4½	99 —101	..	4 9 4
Shawinigan Water, Capital	$100	5½	6†	133 —137	—2	4 7 7
Do. 5 % Con. 1st Mort. Bonds	$500	5	5	105½—107½	..	4 13 0
Do. 4½ % Per. Deb.	Stock	4½	4½	96½ — 98½	..	4 11 5
Toronto Power, 4½ % Deb.	Do.	4½	4½	95 — 98	..	4 11 10
Vera Cruz Lt., P. and T., 5 % 1st Mort. Deb.	100	5	5	80 — 91	..	5 8 9
Victoria Falls Power, Pref.	1	6	6	33/32 — 37/32	—1/32	7 2 0
West Kootenay Power and Lt., 1st Mort. 6 % Gold	100	6	6	103 —105	..	5 14 3

MANUFACTURING COMPANIES.

Aron, Ord.	£	7	..	2/16 — 3/16	..	8 12 4
Do. 6 % Pref.	£	6	6	3 xd — 3½	..	8 0 0
Babcock & Wilcox	£	16	14†	21½ — 21⅝	..	5 8 11
Do. Pref.	£	6	6	1⅛ — 1⅛	..	4 3 6
British Aluminium, Ord.	£	1	..	1 — 1⅛	..	..
Do. 6 % Cum. Pref.	£	1	6	23/32 — 25/32	..	6 12 6
Do. 5 % Prior Liens Debs.	100	5	5	94 — 97	..	5 3 2
Do. Deb. Stk.	100	5	5	85 — 87	..	5 15 0
B.I. & Helsby Cables	£	10	8†	7⅞ — 8¼	..	6 1 3
Do. Pref.	£	6	6	5⅞ — 6¼	..	4 16 0
Do. Deb.	100	4½	4½	100 —103	..	4 7 5
British Thomson-Houston, Deb.	100	4½	4½	92 — 95	..	4 14 9
British Westinghouse, Pref.	£	Nil	..	1⅛ — 1⅛	..	Nil
Do. Deb.	100	4	4	66 — 69	..	5 15 11
Do. 6 % Prior Lien	100	6	6	100 —103	..	5 16 6
Browett, Lindley, Ord.	£	1	..	2/- —3/-	..	Nil
Do. Pref.	£	1	..	8/- —8/6	..	Nil
Brush, 7 % Pref.	£	Nil	..	⅛ — ¼	..	Nil
Do. 6 % Prior Lien Deb.	100	5	5	75 — 80 xd	+5	6 5 0
Do. 4½ % Deb.	100	4½	4½	35½ — 40½	..	11 2 2
Do. 4½ % Second Deb.	100	4½	4½	28 — 27 xd	+2½	16 13 4
Callender's Cable	£	15	6†	10½ — 11½	..	6 13 4
Do. Pref.	£	5	5	4½ — 5 xd	..	5 0 0
Do. Deb.	100	4½	4½	95 — 98 xd	..	4 8 6
Castner-Kellner	£	20	22½	38 — 38	..	6 0 0
Do. Deb.	100	4½	4½	104 —107	..	4 4 1
Crompton & Co., Deb.	100	5	5	68 — 73	..	6 17 0
Dick, Kerr	£	1	Nil	3/32 — 5/32	..	..
Do. Pref.	£	1	6	13/16 — 17/16	..	7 2 2
Edison & Swan, A, £2 paid	£	5	Nil	3/32 — 5/32	..	Nil
Do. fully paid	£	5	Nil	1 — 1⅛	..	Nil
Do. 4 % Deb.	100	4	4	57 — 61	..	6 11 1
Do. 5 % Second Deb.	100	5	5	63 — 68	..	7 7 1
Electric Construction	£	1	5	⅜ — ⅝	..	7 5 6
Do. Pref.	£	1	7	1/16 — 1/16	..	6 11 9
Greenwood & Batley, Pref.	£	10	7	6½ — 7½	..	9 13 2
Do. Deb.	100	5	5	92 — 94	..	5 6 5
General Electric, 6 % Pref.	£	10	6	9⅞ — 10⅜	..	5 15 8
Do. Deb.	100	4	4	88 — 93	..	4 6 0
Henley's, Ord.	£	15	10†	12⅜ — 13½	..	5 11 1
Do. Pref.	£	4½	4½	4⅜ — 5	—1/16	4 10 0
Do. Deb.	100	4½	4½	100 —102	..	4 8 3
India-Rubber, G. & T.	£	10	7½	5 — 11½	..	6 0 0
Do. Pref.	£	10	5	5 — 9½	..	5 0 0
Telegraph Construction	£	12	20	5† 37 — 39	..	6 3 1
Do. Deb.	100	4	4	96 — 98	..	4 1 8
Willans & Robinson, 4 % 1st Mort. Deb.	100	4	4	62 — 66	+1	6 1 3
Do. B 4 % Cum. Pref.	100	..	..	48 — 53	+13	..

TELEGRAPH AND TELEPHONE COMPANIES.

Amazon Telegraph	£	10	4½	4½ 6⅛ — 6⅜	..	6 13 4
Do. 5 % Deb. Red.	Stock	5	5	95 — 97	..	5 3 1
American Telep. & Teleg., Cap.	$100	8	8	124 —127 xd	+10	6 6 0
Do. Collat. Trust	$1000	4	4	88 — 91	..	4 8 0
Anglo-American Telegraph	Stock	3	3	63 — 66	..	4 11 0
Do. 6 % Pref.	Do.	6	6	105½—106½	+ ½	5 13 6
Do. Def.	Do.	30/-	..	24⅜ — 24⅞	..	6 0 7
Anglo-Portuguese Tel., 5 % Mort. Deb.	100	5	5	102 —104	..	4 16 2
Chili Telephone	£	5	8	7⅞ — 7⅞	..	5 5 10
Commercial Cable, Stlg. 4 % Deb.	Stock	4	4	78 — 80 xd	..	5 0 0
Cuba Telegraph	£	10	6†	8 — 9	..	6 13 4
Do. 10 % Pref.	£	10	10	14⅜ — 15½	..	6 9 0
Direct Spanish Telegraph, Ord.	£	5	4	4 8⅜ — 8⅝	..	5 6 8
Do. 10 % Cum. Pref.	£	5	10	6⅞ — 7⅛	..	6 12 0
Direct United States Cable	£	10	4	4† 6⅜ — 6⅝	..	5 18 6
Direct W. India Cable, 4½ % Reg. Deb.	100	4½	4½	98 —100	..	4 10 0
Eastern Telegraph, Ord. Stock	Stock	7	7	124 —127	..	5 10 3
Do. 8½ % Pref. Stock	Do.	8½	8½	75 — 77	..	4 10 11
Do. 4 % Mort. Deb.	Do.	4	4	94 — 96	..	4 8 4
Eastern Extension	£	10	7	7 12 — 12¾	..	5 12 0
Do. 4 % Deb.	Stock	4	4	94 — 96	..	4 3 4
Globe Telegraph and Trust	£	10	6	6† 10⅜ — 11⅛ xd	..	5 7 10
Do. 6 % Pref.	£	10	6	6 11⅜ — 12⅛ xd	..	4 18 0
Great Northern Telegraph	£	10	20	6† 30½ — 32½	..	6 2 8
Indo European Telegraph	£	25	10	5† 57 — 59	..	5 10 2
Mackay Companies Common	$100	5	5	79 — 83	..	6 0 6
Do. 4 % Cum. Pref.	$100	4	4	64 — 68	..	5 17 8
Marconi's Wireless Telegraph	£	1	20	20 3⅛ — 3⅜ xd	..	5 18 6
Do. 7 % Cum. Partic. Pref.	£	1	17	.. 2⅜ — 2⅝	+⅛	6 1 0
Monte Video Telephone, Ord.	£	1	6	6 ⅞ — 1	..	6 0 0
Do. 5 % Pref.	£	1	5	5 ⅜ — ⅝	—1/32	6 8 0
New York Telep., 4½ % Gen. Bnds.	100	4½	4½	97½ — 98½	..	4 11 5
Oriental Telep. and Elec.	£	1	10	10† 1⅝ — 2	..	5 0 0
Do. 6 % Cum. Pref.	£	1	6	6 1⅞ — 1⅞	..	5 1 1
Do. 4 % Red. Deb.	Stock	4	4	85 — 87 xd	..	4 12 0
Pacific and European Tel., 4 % Guar. Debs.	Do.	4	4	97 — 99	..	4 1 0
Reuter's	£	10	10	10† 8¾ — 9½	+ ½	10 10 6
Submarine Cables Trust	Cert.	6	6	129⅜ —135½	..	4 15 7
Telephone Co. of Egypt, 4½ % Deb. Red.	Stock	4½	4½	95 — 97	..	4 12 11
United River Plate Telephone	£	5	8	6† 6⅜ — 6⅞	..	5 16 5
Do. 5 % Cum. Pref.	£	5	5	4⅜ — 5⅛ xd	..	4 13 0
West Coast of America	£	2½	2½	.. 1/16 — 1/16	..	4 8 0
Do. 4 % Debs., 1 to 1,500 guar. by Braz. Sub. Tel.	100	4	4	94 — 97	..	4 2 6
West India and Panama Teleg.	£	10	1½	1½ 2⅛ — 2½	..	5 0 0
Do. 6 % Cum. 1st Pref.	£	10	6	6 9⅜ — 10⅜	..	5 17 0
Do. 6 % Cum. 2nd Pref.	£	10	6	6 9 — 9½	..	6 6 4
Do. 5 % Debs.	100	5	5	98 —100	..	5 0 0
Western Telegraph, Ltd.	£	10	7†	7 12⅜ — 13⅛ xd	..	5 6 8
Do. 4 % Debs.	Stock	4	4	90 — 92 xd	..	4 7 0
Western Union 4½ % Fdg. Bonds	$10.0	4½	4½	92 — 95	..	4 14 9

* Unless otherwise stated all shares are fully paid. † Interim dividend. *a* Paid in deferred interest warrants.

Bank rate of Discount 5 per cent., October 2nd, 1913.

New Swedish A.E.G. Works.—It is reported that the A.E.G. of Berlin has just acquired from the town of Malmö, in South Sweden, a large site on the harbour, on which it is the company's intention to build large works for the manufacture of electrical goods. The Swedish Industrial Association submitted a protest to the authorities of Malmö, in which it was pointed out that the new project would do great harm to the Swedish electrical industry, which had no lack of competitors as it was, and there was thus no reason to dispose of a most valuable site to a foreign firm, which could only have one purpose in view, viz, that of getting a footing in the Swedish market at the expense of the home industry. It was further pointed out that the purchase price, 11s. 2d. per sq. metre was a bargain and quite ridiculous in comparison to the value of the site in question. The Malmö authorities did not, however, take any notice of this protest and the contract with the A.E.G. has been signed. The new factories will find employment for 1,200 men.

Imports into East Africa.—In his report for the year 1912-13, Mr. Major, Chief of Customs, East Africa Protectorate, says that the "activity of the electrical industry during the year is modestly reflected in the returns of electric apparatus imported, which amounted to £3,489." The increase was £1,550, or 80 per cent. over the figures for preceding year. The consignments were mostly from the United Kingdom. The imports of iron and steel manufactures (£28,100), and wires (£3,252), nearly doubled in value, the increase being from £16,613 in 1912, to £31,352 in 1913. The United Kingdom has 64 per cent. of the trade in iron and steel manufactures, but in wire she contributed £35 only, Austria-Hungary's share coming to £1,737, and Germany's to £1,480. The import trade in industrial machinery advanced from £21,065 to £51,572—145 per cent. increase. The trade is in the hands of English manufacturers, Continental countries and the United States only improving by £500.

THE RIGHTS OF A SPECIALIST OR SUB-CONTRACTOR.

[FROM A LEGAL CONTRIBUTOR.]

THERE is no class of person more concerned with the relationship between employer, contractor and sub-contractor than the electrical engineer—using that term, for the moment, to include the wiring contractor and the supplier of electrical fittings. His main concern, of course, is to get paid for the work he carries out; and if it is a question against whom he shall make his claim, he naturally prefers to make it against the right person. Whether he can claim from the employer or the contractor is a question which it is by no means easy even for the lawyer to solve.

A recent case in the House of Lords (Ramsden & Carr *v.* Chessum & Sons, *Times*, Nov. 11th) has drawn attention to the question in a somewhat new aspect. The facts were very simple.

The defendant firm, who were builders, contracted to erect a cinema theatre, the contract being in the form as approved by the Royal Institute of British Architects. The architect to the building owners employed the plaintiffs as specialists to supply certain door handles and door fittings. At the time of receiving the order from the architect, and for some time thereafter, the plaintiffs were ignorant of the names of the builders. The goods were duly supplied and were used by the defendant firm in carrying out their contract. Progress-certificates were granted from time to time under which the defendant firm received large sums from the building owners, but the defendants had not been paid anything which was referable in any possible way to the plaintiffs' goods.

Mr. Justice Hamilton, who tried the case in the first instance, held that the plaintiffs were entitled to recover. He was reversed by the Court of Appeal (Lord Justice Kennedy dissenting). His judgment has now been restored by the House of Lords. The Lord Chancellor, in giving judgment, said that the plaintiffs had failed to show that the architect had acted as agent for the builders; that the plaintiffs had no claim as for money had and received; but that the fact that the goods were delivered to and used by the defendant firm raised no implied promise by them to pay for them.

In the result the sub-contractors had judgment for £142 odd after a long and expensive litigation.

The decision in this case seems to render it desirable to set forth the general principles of law applicable to sub-contractors.

Generally speaking, where there is no stipulation against sub-contracting a contractor may employ sub-contractors. The rule, however, is subject to the qualification that it does not apply when the employer reasonably and naturally looks for the personal service and attention of the contractor. Thus, if the work in hand were of a highly special character it would not be competent for a contractor who was skilled in that class of work to hand over his performance to someone else. It is otherwise, however, when the work involves the exercise of no special degree of skill. Cockburn, C. J., in British Waggon Co. *v.* Lea, 1880, 5 Q.B.D. 149 (at p. 153) thus stated his views of the law on the subject: "Much work is contracted for which it is known can only be executed by means of sub-contracts; much is contracted for as to which it is indifferent to the party for whom it is to be done, whether it is done by the immediate party to the contract, or by someone on his behalf. In all these cases the maxim, *qui facit per alium facit per se*, applies."

The employer is not liable to a sub-contractor, unless an agreement between them can be proved. Such an agreement will not be implied from the mere acceptance of the sub-contractor's work. For instance, where an employer contracted with a builder to do certain work on his house, and a tradesman supplied goods to the builder for use on the house, it was held that the employer was not liable for their price (see the case of Brahmah *v.* Abingdon, cited in Paterson *v.* Gandasequi, 1812, 15 East, 62). The employer does, however, become liable if it can be shown that there is a contract between him and the sub-contractor. For instance, in another case a contractor employed a mason to do certain work as extra to the contract. In an action for work and materials by the mason against the contractor's employer, the plaintiff stated that the work in question was extra to the contractor's contract, and that he had agreed with the contractor to do the work. On production of the contractor's contract, the jury found that there was a distinct contract between the mason and the employer for the work sued on, and judgment was entered for the plaintiff (Eccles *v.* Southern, 1861, 3 F. & F. 142).

An employer may also become liable to a sub-contractor by going surety for him. In that case, however, there must be something in writing, as a contract of guaranty cannot be sued on unless it is written. But there is a difference between a promise to pay the debt of another and a direct promise to be liable oneself in any event. In the latter case, a written contract need not be proved. Thus, if the employer promises to pay the sub-contractor out of moneys which he has to pay to the head contractor, this would be treated as a direct promise to pay (Dixon *v.* Hatfield, 1825, 2 Bing, 439).

There is another way in which the employer may become directly liable to a sub-contractor. It may be proved that the head contractor in employing the sub-contractor really acted as the agent for the employer. The onus of proving this will be on the sub-contractor (see Woodward *v.* Buchanan, 1870, L.R. 5 Q.B. 285).

It is obvious that when a sub-contractor is employed the question whether he will continue to be employed depends upon the conduct of the head contractor. Thus, if the head contractor does some act which entitles the employer to put an end to the contract, the sub-contractor may in his turn be ousted. In that case, the sub-contractor may bring an action for damages against the head contractor, as the law implies that the head contractor will do nothing to prevent the sub-contractor completing his work and earning his profit.

The question—who is the sub-contractor to look to for his remuneration?—naturally turns upon the conditions of his employment. In an ordinary form of agreement a clause is inserted providing that the contractor will pay to the sub-contractor "the sum of £ when the engineer for the time being of the said corporation (*i.e.*, the employer) shall have certified in writing that the said work has been finished and completed to his satisfaction." Other terms are sometimes inserted providing for payment by instalments.

The question of liability largely depends upon whether the contractor was constituted the agent of the employer to employ the sub-contractor or to purchase goods from him, and to establish privity of contract between the employer and such sub-contractor. Where the defendant (a building owner) entered into a contract with a builder by which the latter agreed to build a house for him under the supervision of an architect, the contract provided that the provisional sums for goods to be ordered from special artists or tradesmen should, as the architect should certify, be payable by the builder or the building owner.

The exact terms of the clauses were that: "The provisional sums mentioned in the specification for materials to be supplied or for work to be performed by special artists or tradesmen, or for other works or fittings to the building, shall be paid and expended at such time and in such amounts and to and in favour of such persons as the architect shall direct, and sums so expended shall be payable by the contractor without discount or deduction or by the employer to the said artists or tradesmen."

Special goods according to a particular design were ordered by the builder from the plaintiff, who was a metal worker, and the architect certified the sum for these goods as due from the defendant to the plaintiff, deducting the amount from the certificate given to the builder. It was held that the plaintiff was entitled to recover this sum direct from the building owner (Hobbs *v.* Turner, 1901, 18 T.L.R. 235). In the absence of such a clause a specialist or sub-contractor would be compelled to look for his remuneration to the person who directly employed him, namely, the head contractor.

Trouble frequently arises where, owing to the insolvency of the contractor, the sub-contractor is compelled to look to the building owner. He often makes such a claim without

avail; but by means of a special clause this difficulty may be avoided. So in *re* Wilkinson *ex parte* Fowler (1905) 2 K.B. 713 a district council entered into a contract with a contractor for the construction of certain sewage works. The contract provided that certain machinery for the works was to be supplied to the contractor by certain specified firms, and that "if the engineer shall have reasonable cause to believe that the contractor is unduly delaying proper payment to the firms supplying the machinery he shall have power, if he thinks fit, to order direct payment to them." The contractor having become bankrupt, it was held that the engineer had power to direct the payments to be made to the machinery firms direct. Mr. Justice Bingham said: "I think the clause means that if the persons supplying machinery to the contractor for the purpose of the contract are not promptly and properly paid by him, they can apply to the engineer, and then it shall be competent for the engineer to intervene, and by a proper certificate given in that behalf to require the Council to pay to the machinery firms the amount of their accounts directly—that is to say, not through the hands of the contractor at all, but the money is to be paid directly by the Council to the machinery firms."

If an employer reserves to himself the right of employing specialists to do any portion of the work on a large contract, he does not thereby give an implied undertaking to the head contractor that he will be responsible for any damage caused to the builder by any delay or default on the part of the specialists. In the case of Mitchell *v.* Guildford Union (68 J. P. 54, 1903) a builder undertook to do the whole of a certain piece of work for a certain sum, but part of it was to be done by specialists. The builder undertook to finish the work by a certain date unless he was hindered by (*inter alia*) delay on the part of the engineers or other specialists. The builder was not to be liable for any defects in works provided by the specialists, unless by reason of contributory negligence on his part, or his having paid any final balance to the specialists without first having the architect's written authority to do so. In the course of the work there was delay on the part of the specialists whereby the builder suffered damage. The builder brought an action for breach of contract against the building owners, alleging that under the contract and specification there was an implied promise on the part of the building owners that the delivering and pricing should be done at such reasonable times as to enable the builder to complete his work within a reasonable time thereafter, and that the building owners had broken one or both of these implied promises. It was held that on the proper construction of the contract and specification there was no such implied promise, and that there was no breach of contract on the part of the building owners affording the builder a right to damages (see also Leslie *v.* Metropolitan Asylums District, 1901, 68 J.P. 86). As a general rule, however, the sub-contract contains a clause to the effect that "the sub-contractor shall pay to the contractor the sum of £ as liquidated damages, and not by way of penalty, per day for each day after the day of that the work shall not be finished or complete, and it shall be lawful for the said contractor to retain the said sums out of moneys payable to the sub-contractor."

The liability of a sub-contractor for delay in completing the work he has undertaken to carry out depends on the terms of his contract with the head contractor. If he does not know that the head contractor has undertaken to do the work within a specified time, he will not be liable for the damages claimed and recovered by the employer for delay, but it is otherwise if it is shown that he knew what would be the consequences of delay. These principles may be illustrated by two cases. In the first of these (Portman *v.* Middleton, 1858, 27 L.J.C.P. 231) the plaintiff contracted with a person who may be termed the employer to repair a machine. Part of the machine consisted of a fire-box which the defendant was employed to make within a certain time, the plaintiff was unable to complete his contract with his employer, who sued for and recovered damages. It was shown, however, that the plaintiff would have had time to get another firebox elsewhere. The present action was brought to recover the damages paid to the employer from the sub-contractor. It was held that the damages paid could not be recovered, inasmuch as the terms of the contract with the employer were unknown to the sub-contractor, but that the plaintiff could recover from the defendant the sum of £82 which he had originally paid to the manufacturers, and the extra cost required in getting another firebox elsewhere. In the other case (Hydraulic Engineering Co. *v.* McHaffie, 1878, 4 Q.B.D. 670), the plaintiff company contracted with an employer to make a pile-driving machine. The defendant was employed to make a part of the machine and to deliver the same by the end of August, when, as he knew, the plaintiff company had to make delivery to the employer. The defendant was a month late in making delivery of his part, with the result that the employer refused to accept the whole machine. As it was of peculiar construction, no market could be found for it, and it was therefore sold as old iron. It was held that the plaintiffs were entitled to recover the profits which they would have made on the sale to the employer, and the expenditure thrown away on the other parts of the machine. From this it may be inferred that any sub-contractor for the execution of a portion of a contract for large works may find himself cast in very considerable damages if he is guilty of delay.

ELECTRIC CONVERTER FOR PRODUCING HIGH-FREQUENCY OSCILLATIONS FROM DIRECT CURRENT.

IN a recent issue of the *Physical Review*, W. I. Book describes an "Electric Converter," for the production of high-frequency oscillations from direct-current supply, which apparatus differs much from all methods hitherto used to produce continuous oscillations, although the primary and secondary oscillating circuits are arranged as in the Duddell and Poulsen arc systems.

Referring to fig. 1, the Book converter consists of a powerful electromagnet with tubular pole-pieces *a*, about 7·6 cm. in diameter. The walls of the pole-pieces are reamed out to an end thickness of about 0·45 cm., and to each is attached, as shown, a fibre ring *b* about 10 cm. in outer diameter. This fibre insulation carries a copper cathode-ring *r* (5·6 cm. internal diameter), and one pole-piece is fitted with a fibre plug *c* through the centre of which passes a brass rod *d*. To the end of this rod, which is thus insulated from the pole-pieces, there is attached a zinc or carbon anode disk *e* (5·4 cm. in diameter). The fibre rings *b* project

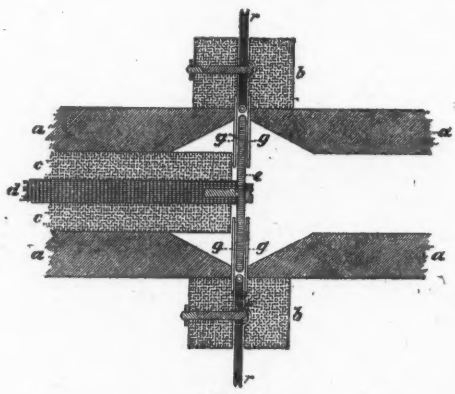


FIG. 1.

slightly beyond the pole-pieces, thus forming recesses into which are fitted mica disks *g*. The anode disk and the cathode ring are insulated completely from the pole-pieces, and the gap between the former obviously lies in a very powerful magnetic field when the magnet coils are excited.

If a difference of potential of 500 volts be established between the anode and cathode under proper conditions, a discharge passes which, by the electrodynamic force to which it is subjected, is compelled to rotate in the annular air-gap between the electrodes. In order to produce oscillations in an oscillatory circuit shunted across the gap, it is necessary that either the anode disk or the cathode ring should have a rough surface, and in practice it is found best to put a regularly roughened surface on the cathode ring. The simplest and most successful method tried was to wind a soft copper wire of, say, No. 16 gauge on to a ring of No. 10 or 11 wire. This wire-wound ring *r* was then soldered into a circular hole cut in a sheet of copper, the latter serving for the connection of the negative supply lead and also as a heat radiator for the cathode ring.

The connections of the converter as used for the production of high-frequency oscillations in a secondary circuit (supply being taken from two ½-H.P. direct-current dynamos in parallel), are shown in fig. 2, in which R_0 represents a variable resistance

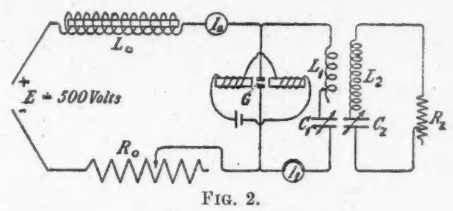


FIG. 2.

capable of varying the main current from 0·1 to 1·0 ampere; I represents a D.C. milliammeter; L_0 a choke coil; G the converter gap; C_1 and C_2 variable oil condensers; L_1 and L_2 the primary and secondary of a closely wound induction coil; I_1 a hot-wire ammeter; and R_2 a variable resistance.

When the connections are made and the proper conditions established for the spark discharge, a spark will rotate in the converter gap between the inside disk and the outer, regularly notched ring. Because of the grooves in the latter, the sparking distance and hence the gap resistance alternates rapidly from a given minimum to a given maximum, but the choke coil in the main circuit meanwhile maintains a nearly constant supply of power through the gap. Owing to the periodically varying resistance of the gap, there is a periodically varying flow and ebb of energy in the primary oscillating circuit. The latter has a natural frequency of its own, and it would appear that the oscillating energy in the primary circuit reaches a maximum when the natural frequency of this circuit is an integral multiple of the frequency of flow and ebb of energy due to the varying resistance of the spark gap. However, the D.C. voltage impressed on the gap, the current in the main circuit, the average length of the spark gap, the pitch of the gap serrations, the intensity of the gap field and other variable factors make the complete determination of the interrelation of the main and primary oscillating circuits a less simple problem than might be expected.

The spark gap may vary in mean length from 0·2 to 2·5 mm. and with a gap of this length, it is necessary to start the discharge by some mechanical means, that actually adopted being to push a small wire into a groove in the fibre next to the cathode ring so that the wire short-circuits the electrodes. The main circuit being thus closed, the wire is immediately withdrawn and the spark discharge commences. Fig. 3 shows the result of using

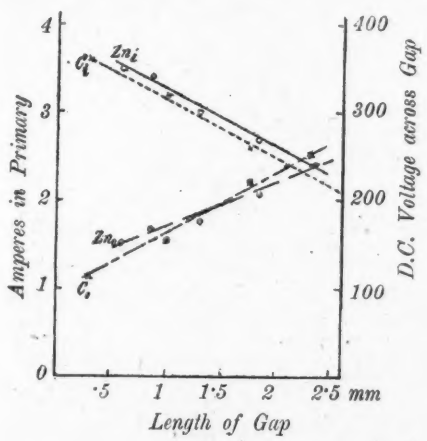


FIG. 3.

various gap lengths; the upper curves Zn_i and C_i show the variation in primary oscillating current with gap length, using zinc and carbon anodes respectively. The lower curves illustrate the variation in D.C. voltage across the gap. For best results, the spark gap should be from 0·4 to 1·5 mm. in length, and experience shows that zinc, carbon, brass and aluminium anodes are all practically of the same value.

If all the conditions in the main and oscillating circuits be kept constant and the field be increased gradually, the current in the primary oscillating circuit increases to a maximum value (as shown by fig. 4, in which curves Z N_2, s, s, refer to gap lengths of 0·85, 1·3 and 2·3 mm. respectively). If the field strength be yet further increased, the spark discharge ultimately sputters or becomes noisy and the energy in the oscillating circuit is decreased rather than increased. No completely satisfactory explanations of this behaviour are yet available.

Curve I_1, fig. 5, shows the increase in primary oscillating current with increasing capacity in that circuit, and Curve I_0 represents the corresponding values of the supply current (gap field 4,500 gauss throughout).

When the main circuit current is too high, the spark discharge is irregular and little energy gets into the oscillating circuit. If the supply current be then gradually decreased, operation becomes smoother and the primary oscillating current increases gradually to a maximum for the capacity then in this circuit. Further slight reduction in the supply current then causes the spark to "blow out"—a phenomenon which suggests that as the energy in the oscillating circuit becomes greater a condition is reached in which the back E.M.F. of the gap, due to the oscillations, reduces the net

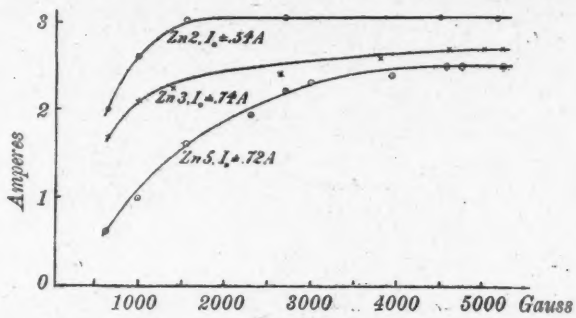


FIG. 4.

voltage across the gap to a value too low to maintain the spark discharge.

A very large number, say 25, of notches per unit length of arc in the spark-gap's circumference is rather disadvantageous than beneficial so far as concerns the amount of energy transferred to the oscillating circuits. If the number of notches be too great, the discharge spreads over several of them, and a regular and considerable variation of the gap resistance is no longer obtained. On

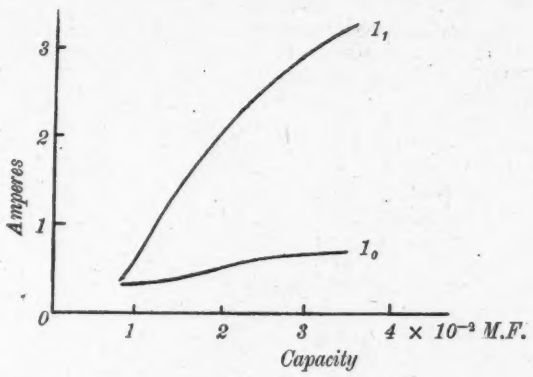


FIG. 5.

the other hand, if the notches be too few, the number of pulses per second is insufficient, with a low field across the gap, to maintain the primary circuit oscillation. However, with only 54 notches in the entire circumference of the gap, the current in the primary increases rapidly as the gap field is strengthened, and best results are obtained with a cathode ring having 10 notches per cm. of arc.

If the converter be in operation with slightly too great a supply current, tuning the secondary to the primary oscillating circuit has the same effect as gradually decreasing the supply current, *i.e.*, the spark discharge becomes more regular and quiet, and the primary current increases. If the gap be operating smoothly before the secondary is tuned, an attempt to effect tuning will often cause the spark to be extinguished.

An interesting application of the Book converter is to be found in wireless telegraphy. One means of producing signals is to join in series with the secondary (antenna) circuit a suitable resistance of, say, carbon-filament lamps, which is then shunted by the signalling key. An alternative method is to connect in parallel with the antenna circuit a secondary which can be tuned to the primary. A double action key is placed in these circuits so that, when the key is pressed, the tuned secondary circuit is interrupted, and energy flows into the antenna circuit, and is radiated from it. It is confidently expected that the Book apparatus will succeed not only in wireless telegraphy, but also in radiotelephony.

Railway Electrification in U.S.A.—An American railway contemporary says it has recently been announced that the Pennsylvania Railroad will electrify a suburban division between Broad Street Station, Philadelphia, and Chestnut Hill, a total distance of 12 miles. The electrification of the main line between Philadelphia and Paloi, which is the terminus for suburban trains, was announced some time ago. It is estimated that the work on the Chestnut Hill division will be completed in about one year. There are at the present time 66 trains per day on the Chestnut Hill branch and 85 trains per day operating between Paloi and Philadelphia.

NOTES ON INTERNATIONAL STANDARDISATION OF ELECTRICAL MACHINERY.

BY A. R. EVEREST, M.I.E.E.

(*Paper read before the* INSTITUTION OF ELECTRICAL ENGINEERS, *at Birmingham, December 10th*, 1913.)

IN order properly to discuss the work of the International Electrotechnical Commission, it is necessary to distinguish clearly between an "International Standard of Quality" and an "International Rating" for machines.

The rating of a machine is the output for which it is sold, and which is marked on its name-plate (rating plate). This output is the "rated output" of the machine.

(*a*) *I.E.C. Standard of Quality.*—If the rated output of a machine is such that when working under the particular cooling conditions for which it is designed the machine keeps within the I.E.C. limits of temperature, this machine, for its particular application, conforms to the I.E.C. Standard of Quality. This standard is particularly valuable for important individual and special applications. Various machines in this class from different sources would still not be directly comparable, since they would not have an equal temperature rise if primarily intended for different conditions.

(*b*) *I.E.C. Rating.*—If the rated output of the machine is such that when working under the I.E.C. standard conditions of cooling the machine keeps within I.E.C. limits of temperature, the rating of this machine is the I.E.C. rating. Thus the I.E.C. rating establishes the temperature rise as well as the maximum temperature. All machines with I.E.C. rating would be directly comparable amongst themselves, since they would all have the same temperature rise at their rated output.

The Rules adopted at the recent I.E.C. meeting in Berlin establish the I.E.C. standard of quality (as regards temperature) for electrical machinery. Agreement was not reached upon the further question of I.E.C. rating, due to differences of opinion regarding the value for the cooling-air temperature. Before referring further to this feature it may be well briefly to review that part of the work which has been completed by the I.E.C.

These Rules are the outcome of deliberations by the various National Committees and at the meetings of the Special Committee on Rating held in Paris and Zurich, and in Berlin prior to the Plenary Meeting.

The Rules so far adopted are based on considerations of the highest safe temperatures for various insulating materials, the joint effect of time and temperature, also the probable difference between observable temperature and maximum internal temperature. From these considerations an international agreement was reached regarding the permissible limits of temperature for various insulating materials employed in modern electrical machinery. In connection with these permissible temperature limits, rules are provided regarding the proper determination of the temperature of the cooling air, a knowledge of which is necessary to ascertain the temperature rise which must not be exceeded at the rated load of the machine.

Finally, rules are provided dealing with the differences which may exist between the temperature rise on test and under service conditions due to variations in the cooling temperature and the barometric conditions. Thus the I.E.C. standard of quality has now been established as regards temperature, and therefore life, for any machine working under the conditions for which it is sold.

While the hottest internal temperature at any point determines the life of the insulation affected, the I.E.C. does not consider it feasible to make this the subject of ordinary commercial investigation. Information obtained from laboratory investigations with exploring coils and thermo-couples built into specially-prepared machines appears to justify the conclusion that for modern machines, wound for not more than 4,000 volts, or for transformer coils for not more than 10,000 volts, the hottest internal spot will not exceed the temperature observed by ordinary methods by more than 10° C. Accordingly, the limiting observable temperatures permitted, which are shown in the table below, apply to measurements by the rise of resistance of the winding (wherever practicable), together with the use of thermometers, the highest reading found being always considered. Electrical thermometers and thermo-couples applied to any accessible part of a completed machine are classed with thermometers.

A great deal of confusion exists between different countries at present concerning the relation between the so-called "full load" rating of a machine and the highest load it is actually expected to carry. Further, the various overloads are rated for different lengths of time, and in some cases are not allowed at all when the machine has been heated up by its ordinary "full load."

The I.E.C. has decided that any machine intended for continuous service should be ordered, designed and rated for the highest load it is expected to carry, and that it should be capable of carrying this rated load continuously without exceeding the temperature limits of the table. No overloads are permissible beyond this rated load.

In the case of a machine subject to peak loads in excess of the ordinary load, if the peak endures for more than a short time it must be included in the rating. But if the peak load is to be endured for brief periods only, the rating must be sufficiently above the ordinary load to give a continuous thermal capacity equivalent to that required on the brief peak loads without exceeding the permissible temperature limits.

A machine for intermittent service may for the purpose of test have either a continuous rating which is thermally equivalent, or a "short time" rating which when starting cold and running at a rated load for a specified time, shall not at the end of that time attain temperatures in excess of those shown in the table.

PERMISSIBLE LIMITS OF OBSERVABLE TEMPERATURE.

Upon these considerations the I.E.C. decided to standardise limiting values for temperature which should apply to "observable temperatures" measured by the means and methods specified, and which should be set with due allowance for such excess internal temperatures above those "observable" as would be associated with the approved methods of test. The temperatures were to be such as might be endured continuously without prejudice to a reasonably long life, but there were to be limits which must not be exceeded. Accordingly, values have been standardised, as shown in the following table :—

Limits of Observable Temperature Adopted by the International Electrotechnical Commission, September, 1913.

Non-impregnated cotton	80° C.
Impregnated cotton or paper (general) ...	90° C.
" single layer field coils, stationary or moving	95° C.
" stationary coils solidly impregnated throughout	95° C.
" rotor and stator windings having the slot portion solidly impregnated or moulded	95° C.
Enamelled wire (without cotton)	105° C.
Mica, micanite, asbestos (general)	115° C.
" single layer field coils, stationary or moving	120° C.
" stationary coils solidly impregnated or moulded	120° C.
Windings permanently short-circuited—	
Insulated	100° C.
Non-insulated	110° C.
Commutators, slip-rings	90° C.
Bearings...	80° C.

NOTE.—When the insulation is composed of several different insulating materials, the lowest of the temperatures corresponding to the various insulations employed must be taken as the temperature limit. The insulation even when forming a support is always considered as part of the winding. (Material employed in small quantity in the construction and not relied upon continuously as a support for the insulating material is not regarded as part of the insulation under this rule.)

Permissible limits of temperature are useless to the designer except in conjunction with information regarding the cooling-air temperature, since the difference between these two values is the "temperature rise" which the machine may create when carrying its rated load. Hitherto in the I.E.C. *Proceedings*, as well as in the various National Rules, the value mentioned as cooling-air temperature has been the "ordinary" or average value. Obviously such value cannot be used directly in connection with a table of limiting temperatures "which must never be exceeded."

The corresponding value of air temperature employed must be the highest which is likely to occur. The British and United States Committees agreed in recommending that in future 40° C. should be taken as the reference air temperature, instead of 25° C., as hitherto indicated in the National Rules. (Unfortunately, some confusion arose because the reason for this sudden jump from 25° C. to 40° C. on the part of the British and United States Committees was not explicitly given.)

The I.E.C. Rules now require that the maximum, and not the average, temperature of the cooling air shall be stated, but agreement was not reached regarding an International Standard reference air temperature. This will be referred to again.

Extended investigations made by the United States National Committee show that the variation in temperature rise with a given load when tested with cooling air at different temperatures is a small and uncertain quantity, sometimes positive, sometimes negative, according to the characteristics of the particular machine. The I.E.C. decided that no correction shall be made in practice for such difference between the conditions of test and of final service.

No correction is to be made for variation in the cooling properties of the air at a given temperature at altitudes not exceeding 1,000 metres. For higher altitudes it is recognised that a correction is necessary, but the I.E.C. is not yet in a position to furnish an official correction factor.

"I.E.C. RATING" FOR MACHINES.

Although the I.E.C. states that "wherever possible the temperature of the cooling air should be stated and the machine constructed for this cooling condition," it is also proposed to establish a value which shall be taken as the maximum temperature of the cooling air when no specific information is available. Probably more than 90 per cent. of all the machines sold come under this class, and the establishment of an International reference air temperature in connection with the Table of limiting temperatures already provided would at once fix the temperature rise permissible at the rated load, and in connection with the rulings given regarding overload would completely establish the capacity of any machine sold with "I.E.C. Rating."

With such uniform rating adopted, a buyer of standard machines could compare, without misunderstanding or possibility of mistake, tenders received from the various makers even from different countries. He would know that all the machines offered would

carry their rated loads continuously with the same temperature rise (and also with uniformity in other characteristics such as commutation, as far as these might be defined by the I.E.C. Rules).

It is evidently desirable that the I.E.C. Rating shall also be the Domestic Standard Rating of the same machines in the countries in which they are produced. The reference air temperature must then be set at such a value as shall not be exceeded by the hottest conditions likely to occur in service at any time of the year in any temperate climate.

At Berlin a majority of the delegates, including those from Great Britain and the United States, desired to set this reference temperature at 40° C., but a minority desired 35° C.

Examination of the meteorological records for various temperate countries, including Great Britain, Germany, and the temperate part of the United States, shows that 35° C. is not sufficiently high to cover even the highest outdoor shade-temperatures which are occasionally recorded, so that with a temperature rise based on the 35° assumption, the limiting temperatures of the I.E.C. Table would certainly be exceeded at times. But such is contrary to the express conditions under which the limiting temperatures were adopted by the I.E.C.

In order to justify a *nominal* "maximum" temperature for cooling air which would exclude the highest peaks occasionally occurring, it would be necessary to reduce all the values shown in the Table of permissible limiting temperatures by a margin sufficient to allow for such occasional peaks. This proposition was suggested at Berlin, but was not accepted by those desiring the lower reference temperature. Finally, this entire question was referred back to the various National Committees, and it is to be hoped that an early settlement will be reached, as upon this question hangs in reality the whole problem of International Standardisation in the rating of electrical machinery.

THE ELECTRICITY SUPPLY OF LARGE CITIES.

By PROF. G. KLINGENBERG, Dr. Ph.

(*Abstract of address delivered before the* INSTITUTION OF ELECTRICAL ENGINEERS, *December 4th*, 1913.)

(*Continued from Vol. 73, page 1062.*)

The comparative data have been summarised in Tables I to III. The energy consumption per head of population cannot be compared directly from the figures given, since both in London and Berlin energy is generated in special traction power stations, and in the case of Berlin that generated in block stations must also be included. Unfortunately reliable data in this connection could not be secured; the figures for the years in question may be assumed, however, to be approximately as follows:—

Current consumption in KW.-hours per head of population:—

Chicago	310 KW.-hours.
Berlin	170 ,,
London	110 ,,

These figures show that in the two latter cities the consumption should be capable of a considerable rise.

It is a striking fact that in London the generation of energy is split up amongst a large number of small stations, whereas Chicago stands pre-eminent as regards centralisation.

The proportion of the average peak loads in the different stations is approximately as follows:—

London	1
Berlin	5
Chicago	10

The installation costs per kilowatt are found to be approximately as follows:—

Berlin	= 950 shillings per installed kilowatt
Chicago	= 1,200 ,, ,, ,,
London	= 1,460 ,, ,, ,,

It is impossible to draw any conclusions regarding costs per kilowatt at Chicago. A comparison is, however, possible between Berlin and London, where methods of design and living conditions

TABLES I and II.

Item.	*Berlin*, 1911-12.	*Chicago*, 1911.	*London*, 1910-11.
Company	Berliner Elektricitäts-werke	Commonwealth Edison Co.	Authorities and companies in and around London.
Population, approx....	2,600,000	2,200,000	6,500,000
Power stations:—			
Number	6	6	64
Installed capacity	137,000 KW.	221,700 KW.	298,400 KW.
Average size ...	23,000 KW.	37,000 KW.	4,670 KW.
Assets	160,426,000s.	280,321,000s.	547,060,000s.
Sinking fund, &c. ...	30,380,000s.	14,148,000s.	111,800,000s.
Real value	130,046,000s.	266,173,000s.	435,260,000s.

COST PER KW. INSTALLED.

	Berlin.		*Chicago.*		*London.*	
Power station ...	355·93s.	38%	477·10s.	40%	662·00s.	45%
Distribution system, including meters ...	593·69s.	62%	723·26s.	60%	797·00s.	55%
	949·62s.	100%	1,200·36s.	100%	1,459·000s.	100%

differ less. From such comparison it will be seen that the total costs per kilowatt installed, with power stations of about 5,000 KW., are approximately 50 per cent. greater than for power stations of about 25,000 KW.; this difference appears to be still greater, namely, 80 to 90 per cent., when the costs of the power stations alone are compared. The proportion of the cost of a power station to that of the network (including meters) is also noteworthy; for Chicago and Berlin it is approximately 40 : 60, and for London 45 : 55. It can thus be seen that the cost of the power station decreases as the size of the plant increases.

TABLE III.

	Berlin, 1911-12.	*Chicago*, 1911.	*London*, 1910-11.
Total peak load	94,600 KW.	199,300	185,500
Peak load per power station	15,800 ,,	33,700	2,900
KW.-hours generated ...	274,000,000	684,000,000	405,000,000
KW.-hours purchased ...	—	32,000,000	—
KW.-hours sold	216,300,000	640,000,000	319,243,000
Comprising—			
Lighting	24 %	19 %	61 %
Power	45 %	12 %	27 %
Traction	31 %	69 %	12 %
Load factor (KW.-hours generated)	33·1 %	41 %	24·9 %
Efficiency of transmisson system—			
KW.-hours sold / KW.-hours generated ...	0·79	0·894	0·788
Reserve factor	1·450	1·11	1·61
Utility factor (total) ...	0·18	0·33	0·122
Coal—Price per ton ...	17·41s.	Approx. 8s.	Approx. 12·8s.
Consumption per KW.-hour sold	1·38 kg.	,, 1·61 kg.	,, 2·37 kg.
Overall efficiency of plant	9·7 %	,, 7·6 %	,, 5 %
Revenue from KW.-hours sold	34,334,000s.	57,845,000s.	62,400,000s.
Expenses	17,636,000s.	28,881,000s.	27,820,000s.
Profit absolute	16,698,000s.	28,964,000s.	34,580,000s.
Percentage of real value ...	12·83 %	10·87 %	7·85 %
	Centi-shillings.	Centi-shillings.	Centi-shillings.
Selling price	15·856	9·044	19·530
Expenses—			
Fuel	2·393	1·146*	3·051
Oil, stores, &c.	0·039	0·045	0·262
Wages	0·510	0·614	1·047
Repairs, maintenance ...	0·937	0·830	1·482
Rent, taxes, insurance, &c.	0·348	0·605	1·482
General expenses ...	0·840	0·836	1·396
Current purchased ...	—	0·167	—
Municipal participation	3·067	0·271	—
Total expenses	8·134	4·514	8·720
Profit (gross)	7·722	4·530	10·810

* The conversion to KW.-hours sold includes the number of KW.-hours purchased, therefore the actual value is approximately 4·5 per cent. higher.

With regard to the consumption, the three plants can be characterised as follows:—Chicago: Traction load predominating (approx. 70 per cent.); London: Lighting load predominating (approx. 60 per cent.); Berlin: Power, lighting, and traction loads, in a more even ratio. London is considerably below the other two cities as regards the utilisation of its plant, owing to its predominating lighting load. Fig. 2 shows that in London the load factor cannot be improved appreciably by centralisation; what is necessary is to alter the nature of the consumption.

The load factor should not largely influence the percentage of reserves. What affects the spares most is the size of the whole plant. The following reserve factors (r) appear to meet the normal requirements of large cities:—With a maximum load on individual stations of 30,000 KW., $r = 1{\cdot}25$; 15,000 KW., $r = 1{\cdot}4$; 3,000 KW., $r = 1{\cdot}6$. It being assumed that each power station is equipped with at least one complete generating set as a stand-by.

The utility factors differ to a greater extent than should be expected from the nature of the consumption alone. The ratios are shown in round figures as follows:—London: Utility factor, 12 per cent.; load factor, 25 per cent. Berlin: Utility factor, 18 per cent.; load factor, 33 per cent. Chicago: Utility factor, 53 per cent.; load factor, 41 per cent. These results, together with the remaining items in Tables I and II, enable their dependence upon the utilisation to be determined, and by means of the costs characteristic thus found, the working conditions can be compared on an equal basis.

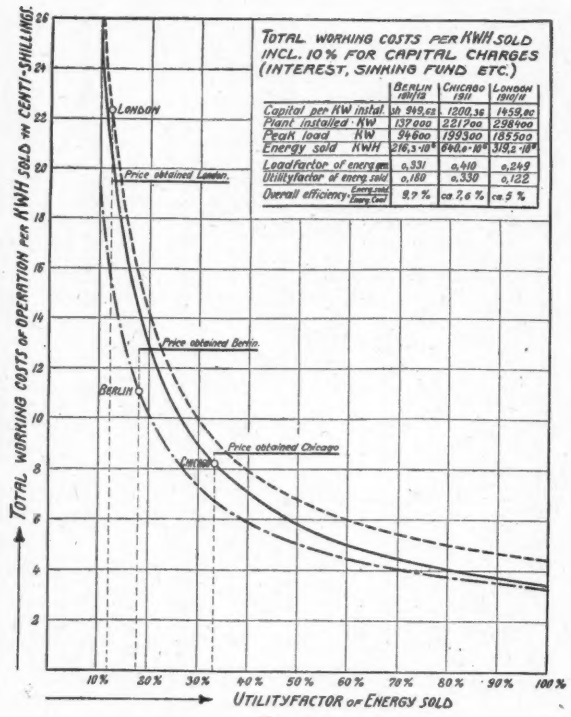
The results of these calculations are shown graphically in fig. 3, which shows the total costs characteristic of the plant. All costs

include the capital charges, and in all three cases the normal rate of 10 per cent. referred to above has been taken.

The actual utility factors, Table III, are indicated in fig. 3 by a circle. They therefore represent the "normal price" of the current, *i.e.*, the price at which the works should earn a gross interest of 10 per cent. on their capital, neglecting any special sums to be paid to authorities.

The prices indicated in fig. 3 by a horizontal line represent selling prices actually obtained by the works during the year in question (after deducting special expenses), and therefore permit a direct comparison with the normal value. I have based my calculations upon the average selling prices throughout, and have ignored the division of the same into various classes of consumption, as this involves the question of tariffs, which does not come within the scope of the present subject.

From these costs characteristics it will be seen that as regards total costs the Berlin works, notwithstanding their smaller power


TOTAL WORKING COSTS PER KWH SOLD INCL. 10% FOR CAPITAL CHARGES (INTEREST, SINKING FUND ETC.)
TOTAL WORKING COSTS OF OPERATION PER KWH SOLD IN CENTI-SHILLINGS.
UTILITY FACTOR OF ENERGY SOLD
LONDON
BERLIN
CHICAGO
Price obtained London.
Price obtained Berlin.
Price obtained Chicago.
10% 20% 30% 40% 50% 60% 70% 80% 90% 100%

	Berlin 1911/12	Chicago 1911	London 1910/11
Capital per KW instal.	sh 949,65	1200,36	1459,00
Plant installed · KW	137000	221700	298400
Peak load KW	94600	199300	185500
Energy sold KWH	216,3·10⁶	640,0·10⁶	319,2·10⁶
Load factor of energy gen.	0,331	0,410	0,249
Utility factor of energy sold	0,180	0,330	0,122
Overall efficiency Energy sold / Energy Coal	9,7 %	ca 7,6 %	ca 5 %

FIG. 3.

stations, work more economically than those in Chicago, while the costs of the London works are the least favourable. Nevertheless, the actual energy prices (based on equal utilisation for all three plants) are approximately the same. The reason for this is that the selling price in London is about 13 per cent. lower, and in Berlin about the same percentage higher than the "normal" value.

The relatively high working costs in Chicago, as compared with those in Berlin, are due, in my opinion, chiefly to the higher costs of the plant (Table II) and the higher wages and salaries. Moreover, the Berlin plants show a decided superiority in fuel consumption, although this is counterbalanced by the appreciably higher prices for coal (Table III).

The importance of the utility factor for all three plants will be recognised from the form of the costs characteristic. The curves show that within the values for this factor of 10 to 30 per cent., the selling price can be reduced by more than 3 per cent. for each advance of 1 per cent. made in utilisation, without necessitating extensions or other alterations to the existing plant.

Comparison of the actual values obtained with those obtainable with modern plant, using machines of 20,000 KW., shows that with the same utility factor, the generating costs in London, for example, could be reduced to less than half of what they are now. Combination of the supply, and particularly a conversion to a pure alternating-current system, enables the costs of losses and distribution to be reduced considerably.

The working costs for the network differ only slightly and form a relatively small part of the total working costs. The saving to be expected here is small, because the greater part of the working costs consists of capital charges. An effective way of improving the conditions would be to replace the existing power stations by large modern plants. This procedure together with better utilisation would mean a saving of 30 per cent. with a relatively small extra capital expenditure.

If, for example, all the existing power stations in London were shut down and large new stations took their place, a saving could be effected of about 40 per cent. on all working costs, at an increase of the total capital now invested of less than 20 per cent.

At this point a further possibility of reducing the working costs should be mentioned which specially applies to large power stations and is dependent upon the site. This consists in a saving of coal costs by building the station in the immediate vicinity of coal-pits, and transmitting the energy through overhead lines or cables. This measure promises advantages wherever high coal freights prevail and where it is possible to use poor coal and obtain a good utilisation of the transmission line. Instead of firing the boilers with the coal direct, advantage may be taken under certain circumstances of the experience in the extraction of its valuable by-products such as nitrogen, tar, oils, &c.

During 1910-11 some 25 electricity works in and round London supplied alternating current at 50 periods, and represented altogether an installed capacity of 126,000 KW. Amongst these there are three concerns with more than 13,000-KW. capacity, totalling 46,000 KW.

These three stations, which are probably of a later date, show a relatively high economy; their immediate replacement is therefore unnecessary. The first step would then consist of providing a new power station having a capacity of 80,000 KW. to replace the 22 smaller stations, and connecting their systems to a common network.

The interconnecting system would be laid out in a manner similar to the system adopted in Berlin for the recent extensions. Several ring mains would be run concentrically round the centre of the city, and the distance between rings would vary according to the density of consumption. These ring mains would be duplicated in case of extensions and connected to one another by diagonal feeders.

In order to obtain an idea as regards the length and the costs of the cables, I have drawn in a system of this kind (fig. 4) diagrammatically on a map of London, making due allowances for the increasing density of supply (shown by the closeness of the hatching) and the possibility of connecting up all the existing companies to the system. On the assumption (that the total output of about 80,000 KW. is to be distributed) I consider that three ring mains, each consisting of one single three-phase cable, 3 × 150 sq. mm. (3 × 0·235 sq. in.), capable of transmitting 10,000 KW., should be sufficient. With this arrangement each of the stations belonging to the outer ring will be fed by at least two cables, while the cables laid diagonally provide for the necessary cable reserve in the interior of the city. I estimate that a ring system in accordance with the diagram shown in fig. 4 will suffice for the distribution of 150,000 KW., showing that there is ample provision for further connections.

The total length of the cables would be approximately 250 km. (155 miles), allowing 15, 20, and 30 per cent. for deviations from the straight line.

Twenty-five stations with an installed transformer capacity of 80,000 + 25 per cent. = 100,000 K.V.A. would be connected to the ring mains.

The new generating station is assumed to be situated within a distance of 15 km. (10 miles) from the centre of the city on a site of 50 ha. (130 acres).

Ten 20,000-volt cables, with the same dimensions and carrying capacity as the ring mains, would connect the latter to the power station. If the average length of the cable between the power station and the feeding points is assumed to be the same as the distance of the power station from the centre of the city, an additional allowance of 20 per cent. being made for following streets, the total length of the cable would be 180 km. (110 miles).

The maximum losses in this cable would be approximately as follows:—180 KW. dielectric losses, 3,240 KW. copper losses. On the above assumptions the costs work out as follows:—

A. *Estimate*—

	Shillings.
1. Power station, 83,000 KW., including transformers, switch-house and auxiliary buildings, at 170s. per KW. (extra for site, pile foundations, pumping plants, labour, &c., at 40s. per KW.); total	17,430,000
2. Feeder cables, 180 km., 20,000-volt 3 × 150 sq. mm. section, including laying, at 27,800s. per km.	5,000,000
3. Ring cables, 250 km., 20,000-volt 3 × 150 sq. mm. section, including laying, at 31,000s. per km.	7,750,000
4. Sub-stations: 25 with stationary transformers. Total capacity, 100,000 K.V.A., allowing for the partial use of existing buildings and sites, at 40s. per K.V.A.	4,000,000
Total cost	34,180,000
Per KW. 427·25s.	

B. *Operating Costs for the New Plants*—

Capital charges—Power station and sub-station, 10 per cent.; cable, 8 per cent.

Coal—Price per ton, 10s. 6d.; calorific value per kg., 7,000 cal. (12,600 B.TH.U).

Utility factor for all parts based on full load, 80,000 KW.

I have further assumed that in view of the high proportion of the lighting load, the new power station can deal with the entire supply without assistance during a considerable part of the year, and that the three old power stations need be operated for not more than an average of eight months in the year.

The utility factors are to be based as regards capital charges on the existing plant of 126,000 KW., and as regards operating costs on the capacity installed in the three old stations of 46,000 KW.

The figures obtained from the comparative calculations are combined in Table IV. The results of these calculations may be summarised in the following statement. The plan proposed permits payment of interest and amortisation of the old capital in the same

manner as hitherto, and leaves a reasonable sum for capital charges on the new capital and a surplus of 5,200.000s. This profit is secured without making any alterations in the existing distribution system. The increase from 135,000,000 KW.-hours, to 172,000,000 KW.-hours would meet the natural increase in the consumption during the construction period.

We will now consider the effect of the above scheme on concerns supplying continuous current. In 1910-11 there were 29 companies under this heading with an installed capacity of 116.000 KW. If the largest of these stations with outputs of 10,000 KW. might

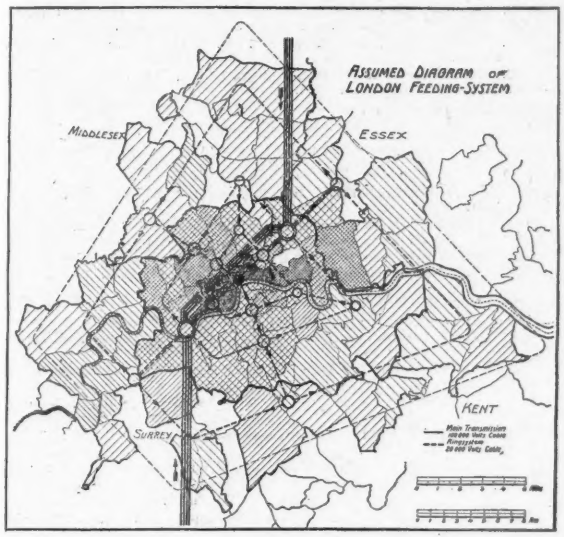


FIG. 4.

at first remain in commission (there are three of these works with a total output of 54,000 KW.), the others would be shut down, and as the ring mains have still an ample reserve, the only alteration would be the installation of 62,000 KW of converters and transformers, the laying of about seven additional feeder cables, and the extension of the new power station by three generating sets. This alteration should be carried out at a cost of about 310s. per kilowatt installed. After this alteration about 80 per cent. of the existing plant will have been combined and transformed into an efficient supply system. The conversion of the remaining concerns with non-standard systems would probably no longer offer great difficulties.

(To be continued.)

FOREIGN AND COLONIAL TARIFFS ON ELECTRICAL GOODS.

AMENDMENTS.

FRANCE.—The French Customs Authorities have decided that electric lamp brackets fixed on cables for chains of lights are to be dutiable as electro-technical apparatus, the electric cables to be dutiable separately according to class.

The Board of Trade are in receipt, through the Foreign Office, of information to the effect that a proposal to reduce from 5 per cent. to 1 per cent. the margin allowed for error in Customs declarations for goods imported into France is contained in Article 22 of the Bill which is being considered by the Budget Committee of the Chamber of Deputies. The Article in question proposes that Article 16 of the Law of the 28th December, 1895, shall be abrogated, and that Article 18 of Chapter II. of the Law of the 6th/22nd August, 1791 ("*Code des Douanes*"), shall read as follows:—

If the goods presented (for clearance) exceed by more than *one* per cent. the weight, the number or the measure declared, the provisions of Article 21 of the present Chapter shall be applicable. With regard, however, to goods other than metals, dutiable, by weight, at 10 francs or less per 100 kilogrammes, the penalties will be incurred only if the excess weight is over 10 per cent. of the declared weight.

The amount of the excess is to be calculated in relation to the weight, the number or the measure set out in the declaration, or in a note annexed thereto, for each article, group of packages, or packages comprised in one declaration (*dans un même article*), or for each class of goods contained in one and the same package.

In forwarding this information, H.M. Ambassador at Paris reports that in the preamble to the Bill it is stated, with reference to this proposal, that the adoption of measures more restrictive than those now in force is rendered necessary by the desire of the Customs authorities to reduce the number of their examinations of consignments, and also to prevent a special kind of fraudulent practice which consists in grouping a number of packages under one declaration and taking advantage of the margin allowed for errors.

[*Note.*—Article 16 of the Law of the 28th December, 1895 (which it is now proposed to abrogate) provides that if the goods presented (for clearance) exceed by more than 5 per cent. the weight, the number, or the measure declared, the excess shall be subject to the payment of quadruple duty. As regards goods other than metals, dutiable, by weight, at 10 francs or less per 100 kilogrammes, quadruple duty shall be exacted only if the excess weight is over 10 per cent. of the declared weight.]

Article 21 of Chapter II. of the 6th/22nd August, 1791, provides that in the case of false declarations in regard to the quality or the kind of the goods, the latter shall be confiscated and a fine of 100 francs shall be imposed if the duty which would be evaded by the false declaration amounts to 12 francs or more. If the duty sought to be evaded amounts to less than 12 francs, the goods shall not be confiscated, but only the fine of 100 francs exacted.

In this connection we note that the British Chamber of Commerce is protesting against the imposition of this further disability on trade between the two countries.

NEW PATENTS APPLIED FOR, 1913.

(NOT YET PUBLISHED.)

Compiled expressly for this journal by MESSRS. W. P. THOMPSON & Co., Electrical Patent Agents, 285, High Holborn, London, W.C., and at Liverpool and Bradford, to whom all inquiries should be addressed.

28,853. "Automatic electric music-turner." M. KOOPMAN. December 15th.

28,854. "Electric conduit fittings." R. W. PERRY. December 15th.

28,887. "Apparatus to be used in connection with testing electrical potential differences in the earth." E. RYAN. December 15th.

28,894. "Vacuum lightning-arresters." WESTERN ELECTRIC CO., LTD. December 15th. (F. T. Woodward, Belgium.) (Complete.)

28,898. "Arrangements for automatically regulating the voltage of dynamo machines." FRIED KRUPP AKT. GES. December 15th. (Convention date, January 11th, 1913, Germany.) (Complete.)

28,903. "Holders for electric glow lamps." H. LEITNER. December 15th.

28,915. "Electric lamp holders." A. H. BRACKENSIECK. December 15th.

28,932. "Electric water-heaters and the like." R. WEAVING & FERRANTI, LTD. December 15th. (Addition to 9,930/13.)

28,933. "Reversing and braking alternating-current motors." AKT. GES. BROWN, BOVERI ET CIE. December 15th. (Convention date, December 27th, 1912, Germany.) (Complete.)

28,935. "Electric glow lamps and methods of manufacturing and operating the same for illumination, heating and other purposes." C. O. BASTIAN. December 15th.

28,939. "Apparatus for perforating tape for the automatic transmission of telegraphic signals and for other like purposes." EASTERN TELEGRAPH CO., LTD., A. FRASER and K. L. WOOD. December 15th.

28,950. "Magnetic balances." R. W. PAUL. December 16th.

28,952. "Telegraph receiving-apparatus adapted to split up incoming signals into their components, and to actuate a transmitter or analogous device, or to perforate a tape according to either the Wheatstone, cable, or other systems of working." EASTERN TELEGRAPH CO., LTD., A. FRASER and K. L. WOOD. December 16th.

28,956. "Electric signalling-systems for mines." A. W. BROWN and I. H. PARSONS. December 16th.

28,963. "Insulated railway van." W. HUNT. December 16th. (S. T. Gresham, India.) (Complete.)

28,966. "Collectors used in connection with dynamo electric machines." W. P. THOMPSON. December 16th. (Aktiebolaget Ljungstroms Angturbin, Sweden.) (Complete.)

28,967. "Rotary field magnets." W. P. THOMPSON. December 16th. (Aktiebolaget Ljungströms Angturbin, Sweden.) (Complete.)

28,977. "Electric signalling and train-control systems for railways." W. J. MACKENZIE. December 16th.

28,999. "Thermo-electric generators." P. FERRA. December 16th.

29,003. "Flexible connections for electric conductors." SIEMENS BROS. DYNAMO WORKS, LTD. December 16th. (Siemens-Schuckertwerke Gm.b.H., Germany.) (Complete.)

29,007. "Means for the electrical treatment of toothache and the care of the teeth generally." E. L. PECK and T. N. ATKINSON. December 16th.

29,028. "Method of covering or armouring electric conductors with metal." F. CHASE. December 16th. (Complete.)

29,046. "Selective electric signalling." NEW PHONOPORE TELEPHONE CO., LTD., and A. H. NICHOLSON. December 16th.

29,049. "Circuit arrangements for telephone systems." SIEMENS & HALSKE AKT. GES. December 16th. (Addition to 12,651/13. Convention date, December 18th, 1912, Germany.) (Complete.)

29,059. "Sparking plugs." C. SPADA. December 16th. (Convention date, February 25th, 1913, Italy.) (Complete.)

29,063. "Regulators for electric transforming apparatus." BRITISH THOMSON-HOUSTON CO., LTD. December 16th. (General Electric Co., United States.)

29,070. "Electrically-heated utensils." W. F. PERRY and CREDENDA CONDUITS CO., LTD. December 16th.

29,098. "Electric lamps." R. S. BALLANTINE and J. LIZARS. December 17th.

29,099. "Mains for collecting and conveying gases from electrolytic cells and the like." A. E. KNOWLES. December 17th.

29,106. "Electrical alarm clocks." R. WILLIAMS. December 17th.

29,108. "Plug connection adapted to fit into a wall switch." R. D. BINNEY. December 17th.

29,113. "Dynamo-electric machines." J. G. CUNLIFFE and R. G. CUNLIFFE. December 17th.

29,118. "Renewable electric elements suitable for self-contained electric kettles and other apparatus." G. H. CLARKSON. December 17th.

29,165. "Telephone transmission systems wherein reinforcing repeaters are employed." A. S. J. VAN KESTEREN. December 17th. (Convention date, December 19th, 1912, Holland.) (Complete.)

29,182. "Electric clocks." F. T. REID and F. KNIGHT. December 18th.

29,195. "Production of alkali metal by the electrolysis of fused salts or mixtures of salts." R. J. MCNITT. December 18th.

29,203. "Ventilation of dynamo-electric machinery." SIEMENS BROS. DYNAMO WORKS, LTD., and E. O. KIEFFER. December 18th. (Complete.)

29,216. "System of electrical distribution and control." F. B. MACNAB. December 18th. (Convention date, December 26th, 1912, United States.) (Complete.)

29,221. "Receiver for submarine sound signals." SIGNAL G.M.B.H. December 18th. (Addition to 2,185/13. Convention date, December 18th, 1912, Germany.) (Complete.)

29,225. "Dynamo-electric generators." F. L. HOLLISTER. December 18th. (Addition to 27,356/12.)

29,233. "Insulating compound." E. JONES. December 18th.

29,237. "Method of removing air from incandescent lamp bulbs." R. BELL. December 18th.

29,239. "Method of and means for reducing the influence of the line capacity in actuating electric apparatus at a distance, by means of pulsations obtained from a source of continuous electric current." E. H. WIDEGREN and K. A. WIDEGREN. December 18th. (Convention date, December 30th, 1913, Sweden.) (Complete.)

29,240. "Method of and means for effecting a diplex action in actuating electric apparatus at a distance by means of pulsating electric currents obtained from a sou ce of continuous electric current." E. H. WIDEGREN and K. A. WIDEGREN. December 18th. (Convention date, December 30th, 1912, Sweden.) (Complete.)

29,241. "Transmitter of electric writing telegraphs." E. H. WIDEGREN and K. A. WIDEGREN. December 18th. (Convention date, December 30th, 1912, Sweden.) (Complete.)

29,242. "Electric writing telegraphs." E. H. WIDEGREN and K. A. WIDEGREN. December 18th. (Convention date, December 30th, 1912, Sweden.) (Complete.)

29,245. "Telephonic connections." S. G. BROWN. December 18th.

29,250. "Electric cells or batteries." C. K. BAMBER. December 18th.

29,259. "Method of protecting the electrodes in electric arc furnaces." J. I. BRONN and W. SCHEMMANN. December 18th. (Convention date, December 18th, 1912, Germany.) (Complete.)

29,260. "Electrically-insulated fish-joints for railway rails." W. R. SYKES INTERLOCKING SIGNAL CO., LTD., and G. H. SYKES. December 18th. (Complete.)

29,270. "Commutation arrangements for electric rotary converters coupled to alternating current boosters." SIEMENS BROS. DYNAMO WORKS, LTD., and J. C. WILSON. December 18th. (Complete.)

29,274. "Current carrying coils for electro-magnetic apparatus." J. W. EWART. December 19th.

29,284. "Electric lamp for advertisements, signals, or the like." S. KLEIN. December 19th. (Convention date, December 20th, 1912, Germany.) (Complete.)

29,341. "Electric tumbler switches." GEB. JAEGER. December 19th. (Convention date, November 27th, 1913, Germany.) (Complete.)

29,344. "Pendant switches." GEB. JAEGER. December 19th. (Convention date, November 27th, 1913, Germany.) (Complete.)

29,346. "Devices for correcting the difference of phase in telegraphic receiving-apparatus." A. C. BARONIO and K. L. WOOD. December 19th.

29,361. "Dynamo-electric machines for combined electric lighting and engine starting." B. BROOKS and W. HOLT. December 20th.

29,366. "Limit switches employed to control the movements of electrically-operated cranes, hoists, freight and passenger elevators, winches, turntables, and the like." CRAVEN BROS., LTD., F. GARNER and A. E. HORROCKS. December 20th.

29,389. "Apparatus for perforating tape for automatic telegraph transmitters and the like." A. C. BARONIO and K. L. WOOD. December 20th. (Divided Application on 29,416/12. December 20th.)

29,418. "Cathodes for electric furnaces." G. B. ELLIS. December 20th. (Sodium Process Co., United States.) (Complete.)

29,425. "Globes for electric arc lamps." T. STAVE. December 20th. (Convention date, December 23rd, 1912, United States.) (Complete.)

29,426. "Circuit arrangements for automatic or semi-automatic telephone systems." SIEMENS & HALSKE AKT. GES. December 20th. (Addition to 18,498/12. Convention date, December 20th, 1912, Germany.) (Complete.)

29,434. "Relays for telegraphy." J. TUCKER and C. G. E. MILNE. December 20th.

29,447. "Apparatus suitable for use in wireless telegraphy and telephony." J. SCHIESSLER. December 20th. (Convention date, October 16th, 1913, Austria.) (Complete.)

29,448. "Electrical relays." KEMP & LAURITZEN. December 20th. (Convention date, February 27th, 1913, Denmark.) (Complete.)

29,449. "Oscillating electric fans and the like." A. BERGTHEIL. December 20th.

29,452. "Preparing aluminium or its alloys for electro-plating." H. D. CUNNINGHAM. December 20th.

PUBLISHED SPECIFICATIONS.

Copies of any of the Specifications in the following list may be obtained of MESSRS. W. P. THOMPSON & Co., 285, High Holborn, W.C., and at Liverpool and Bradford; price, post free, 9d. (in stamps).

1912.

19,257. ELECTRICAL DRIVING-GEAR FOR CLOCKS AND THE LIKE. L. J. Aron, C. Wiener, and X.L. Electric Co. August 22nd. (Patent of Addition not granted.)

24,254. RESINOUS AND WAX-LIKE CONDENSATION PRODUCTS AND PROCESS OF MAKING THE SAME. British Thomson-Houston Co. (General Electric Co.) October 23rd. (Samples furnished.)

26,680. ELECTRIC ROTARY CONVERTERS. British Thomson-Houston Co. and F. P. Whitaker. November 20th.

26,912. STARTING SWITCHES FOR ELECTRIC MOTORS. V. G. Middleton and others. November 22nd.

26,961. ELECTRIC PROTECTIVE SYSTEMS. F. G. Waters. November 23rd.

27,011. AUTOMATIC SLIP REGULATORS FOR ELECTRIC INDUCTION MOTORS. British Thomson-Houston Co., J. J. Ash and A. H. St. C. Watson. November 23rd.

27,236. ELECTRIC CONTROL SYSTEMS. British Thomson-Houston Co. (Allgemeine Elektricitats Ges.) November 26th.

27,382. APPARATUS FOR THE WINDING-UP AND STARTING OF THE NUMBER SWITCHES IN AUTOMATIC TELEPHONE SUBSCRIBERS' STATIONS. Zivnostenská Banka v. Praze (Firm of.) November 28th. (November 28th, 1911.)

27,563. CONTROLLING DEVICE FOR ELECTRIC MOTORS. A. H. Curtis, A. R. Mackley, and Adams Manufacturing Co. November 30th.

27,609. PERMUTATION SWITCH DEVICE FOR ELECTRIC BOLTS, ALARMS, AND THE LIKE. L. L. Leduc. November 30th.

27,610. ELECTROMAGNETIC BOLTS FOR LOCKS. L. L. Leduc. November 30th.

27,624. CONTROL OF ELECTRIC MOTORS. British Thomson-Houston Co. (Allegemeine Elektricitats Ges.) November 30th.

27,633. ELECTRIC BATTERIES. W. H. Lowe. November 30th.

27,664. DYNAMO-ELECTRIC MACHINES. Brolt, Ltd., B. Brooks, and W. Holt. December 2nd. (Addition to 26,880/10.)

27,714. SAFETY LAMPS FOR MINES. F. Palmer. December 2nd.

27,747. ARTIFICIAL ILLUMINATION FOR PHOTOGRAPHIC PURPOSES. A. C. Adams and M. A. Adams. December 2nd.

27,881. REDUCTION OF ZINC ORES IN THE ELECTRIC FURNACE. W. Mc. A. Johnson. December 3rd. (October 17th, 1912.)

28,300. VARIABLE-SPEED HYDRAULIC TRANSMISSION GEAR, PARTICULARLY APPLICABLE TO THE ELECTRIC LIGHTING SYSTEMS OF RAILWAY CARRIAGES OR OTHER VEHICLES. Variable Speed Gear, Ltd., and J. Robson. December 7th.

28,605. CONTROL GEAR FOR ELECTRICAL AND OTHER MACHINERY. G. H. Rae and Cunard Steamship Co. December 11th.

28,665. ELECTRICALLY-OPERATED PULLEY BLOCK. W. E. Evans. (Deutsche Maschinenfabrik Akt. Ges.) December 12th.

28,953. SALICYLATE ELECTROLYTES FOR USE IN THE ELECTROLYTIC DEPOSITION OF METALS OR METALLIC ALLOYS. P. Marino. December 16th.

29,750. ELEMENT FOR ELECTRICAL HEATING. H. J. Dowsing and D. Huntley. December 24th.

29,863. CONSTRUCTION OF ELECTRO-MAGNETS. Steel, Peech & Tozer, Ltd., and H. E. Bowen. December 28th.

1913.

78. MECHANICAL GRIPS FOR ELECTRICAL WIRES. S. W. Martyn. January 1st.

759. ELECTRIC WATER-HEATERS. Unit Engineering Co. and F. A. Brown. January 10th.

1,299. SELECTING DEVICES FOR TELEPHONE AND OTHER EXCHANGES. Siemens Bros. & Co., and T. Pettigrew. January 16th.

2,009. SYSTEMS FOR MEASURING THE CAPACITIES OF ELECTRIC CIRCUITS. G. A. Campbell, O. B. Blackwell and E. H. Colpitts. January 24th. (April 11th, 1912.)

3,148. ELECTRICAL HEATING AND DRYING APPARATUS. British Thomson-Houston Co. (General Electric Co.) February 6th.

3,682. SOCKETS FOR INCANDESCENT ELECTRIC LAMPS. H. Hubbell. February 12th.

3,685. ELECTRIC MOTOR CONTROL SYSTEMS. British Thomson-Houston Co. (General Electric Co.) February 12th.

4,699. ELECTRIC FLASH LAMP FOR USE AS A FOG SIGNAL. R. C. Douglas. February 24th.

4,835. ELECTRIC SWITCHES. British Thomson-Houston Co. (General Electric Co.) February 25th.

5,029. APPARATUS FOR EXHIBITING PICTURES, ADVERTISEMENTS, AND THE LIKE. W. J. Mellersh-Jackson. (Elektro-Reklame Ges.) February 27th.

5,209. ELECTRIC INCANDESCENT LIGHTS. H. W. Fuller. March 1st.

5,523. ELECTRIC FUSE PLUGS. British Thomson-Houston Co. (Allgemeine Electricitâts Ges.) March 5th.

7,221. TELEPHONE SYSTEMS. G. Ahlemeyer. March 26th. (December 27th, 1912.)

7,599. PHOTOGRAPHER'S FLASH-LAMP. G. R. S. Greenberg. March 31st.

8,665. ELECTRIC SWITCHES. L. Rasch. April 12th.

9,769. AUTOMATIC SWITCH APPARATUS FOR ELECTRICALLY ILLUMINATED ADVERTISEMENTS AND THE LIKE. M. Langer. April 25th.

10,289. ELECTRIC RADIATORS FOR HEATING. C. Arpin. May 1st. (May 2nd, 1912.)

10,579. ELECTRICALLY-HEATED APPARATUS. E. C. R. Marks. (Landers, Frary, and Clark.) May 5th.

11,103. ADVERTISING APPARATUS. L. Kaufmann. May 10th. (January 10th, 1913.)

11,131. ELECTRIC RELAYS. A. N. Hovland. May 10th.

11,628. TRAIN COMMUNICATING-SIGNALS. H. A. Robinson. May 19th.

11,990. ELECTRIC IGNITION GENERATORS. B. Lawrence. May 22nd. (Patent of Addition not granted.)

12,566. CIRCUIT ARRANGEMENTS FOR TELEPHONE SYSTEMS. Siemens Bros. & Co. (Siemens and Halske Akt. Ges.) May 29th.

13,406. ATTACHMENT OF THE FILAMENTS OF ELECTRIC GLOW LAMPS TO THE LEADING-IN WIRES. J. Plechati. June 10th.

13,546. PNEUMATIC-ELECTRIC TRACKER BARS FOR AUTOMATIC MUSICAL INSTRUMENTS. C. W. Dorricot. June 11th.

14,729. LOUD SPEAKING TELEPHONE STATIONS. H. Wade. (Elektrizitats Akt. Ges. Hydrawerk.) June 25th.

14,780. TELEPHONE TABLE INSTRUMENTS OR THE LIKE. G. Meyer. June 26th. (August 1st, 1912.)

15,719. STORAGE BATTERY GRIDS. E. F. Wackwitz. July 8th. (July 8th, 1912.)

15,950. COMBINED VOLTAGE REGULATORS AND SWITCHES FOR VARIABLE SPEED GENERATORS. A. Pollak. July 10th. (July 18th, 1912. Addition to 16,782/12.)

17,137. ELECTRIC RELAY. Siemens and Halske Akt. Ges. July 25th. (February 12th, 1912. Divided Application on 3,432/13. February 10th.)

17,261. ELECTRIC CONDUCTOR FOR EXPLOSIVE CHARGES. H. J. von Klaedon. July 28th.

17,775. ELECTRICAL SWITCHES OR INTERRUPTERS FOR TELEPHONE CIRCUITS. W. A. Logan. August 2nd.

18,102. PROCESS AND APPARATUS FOR THE ELECTROLYSIS OF HALOGEN ALKALIS. Siemens and Halske Akt. Ges. August 8th. (February 20th, 1913.)

18,592. ELECTRICALLY-HEATED FOODWARMERS. A. Jung. August 15th.

19,270. VIBRATION DAMPING DEVICE FOR METERS OR LIKE DELICATE INSTRUMENTS. E. F. C. Seignol. August 25th. (September 6th, 1912.)

21,222. CIRCUIT ARRANGEMENTS FOR TELEPHONE SYSTEMS. Siemens & Halske Akt. Ges. September 19th. (November 9th, 1912.)

22,723. ELECTRIC FURNACES. E. Stassano. October 8th. (Addition to 8,901/11.)

22,724. ELECTRIC FURNACES. E. Stassano. October 8th.

24,054. STARTING SWITCHES FOR ELECTRIC MOTORS. V. G. Middleton and others. October 23rd. (Divided Application on 26,912/12. November 22nd.)

24,911. ELECTROSTATIC MACHINES. E. Oppen. November 1st. (October 14th, 1913.)

Electrical Exhibition at Barcelona.—In connection with the proposal to hold an International Exhibition of machinery, plant, and appliances, connected with electrical industries, at Barcelona in 1915 the *Glasgow Herald* states that Mr. F. Witty, a member of the Executive Committee of the British Chamber of Commerce for Spain, will come to London shortly with a Spanish colleague in order to work up British interest in the enterprise. The British Chamber of Commerce is taking considerable interest in the scheme in view of the opportunity offered to British manufacturers to get in touch with the Spanish public. A great demand for electrical machinery and fittings is expected during the next two years.